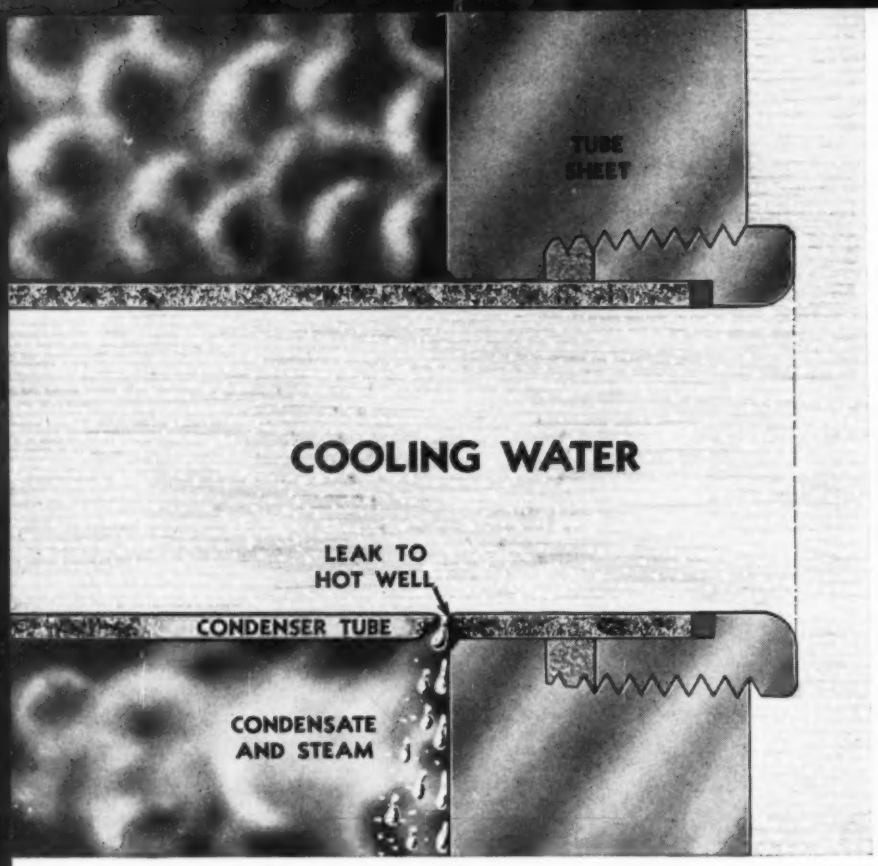
...ODY DEPT.

POWER

JULY, 1943



Want to Immobilize This Leak?

To keep contaminated condensate from sneaking into a boiler's tubes and sabotaging its steam production, we can supply an instrument which will warn of the potential damage at its source until the maintenance crew closes the leak and thus ends the contamination. The method employed is to measure, continuously, the electrolytic conductivity of the condensate.

In the power industry's steam stations, conductivity is checked at each surface condenser and after the pump, and at the drains of the stage heaters, by a multiple-point Micromax Strip-Chart Recorder. This instrument records the points, in rotation, at a rate of about a minute per point, on a chart approximately ten inches wide; the record may be in one color or in as many as six. The Micromax sounds an alarm or operates a signal light, as you prefer.

In many industrial power plants, where the condensate comes principally from the heaters for digesters, evaporators, cookers, etc., the preferred Micromax Recorder is apt to be a single-point instrument, normally connected to the main condensate return. When a leak shows, a dump valve opens to run the condensate to waste, while an operator switches the Recorder's connections, by hand, to the various lines which feed the header, until he has run down the leaking unit. The Recorder used may be either a Strip-Chart or a Round-Chart; the latter gives a narrower record but its indi-

far as it can be seen.

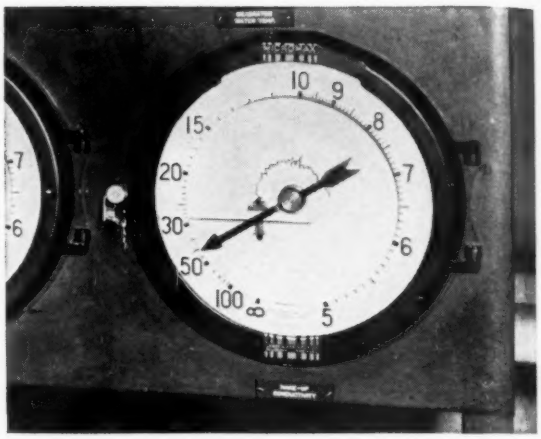
ly dependable, perfected ma-

ry service in this application.

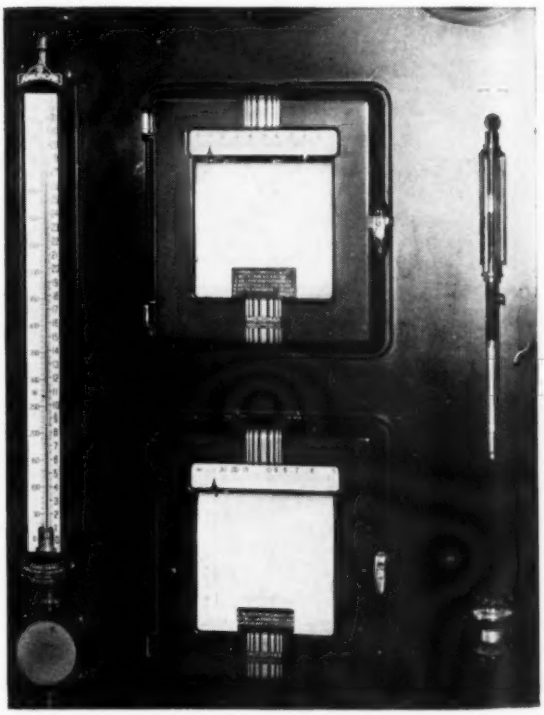
163, sent on request; but if

vity measurement could help,

ly send more specific recom-



Typical Round-Chart Micromax Conductivity Recorder guarding the condensate return of a pulp mill. Calibration is in thousands of ohms.



Typical Micromax Strip-Chart Conductivity Recorder on a central station's turbine board. It shows conductivity at hot well, or conductivity of condensed evaporator vapor, as manually selected. The upper instrument is a Micromax Temperature Recorder for steam, water and air temperatures; each is in a separate color.

ARMY E NAVY

depends on me!

A Slogan For All Americans

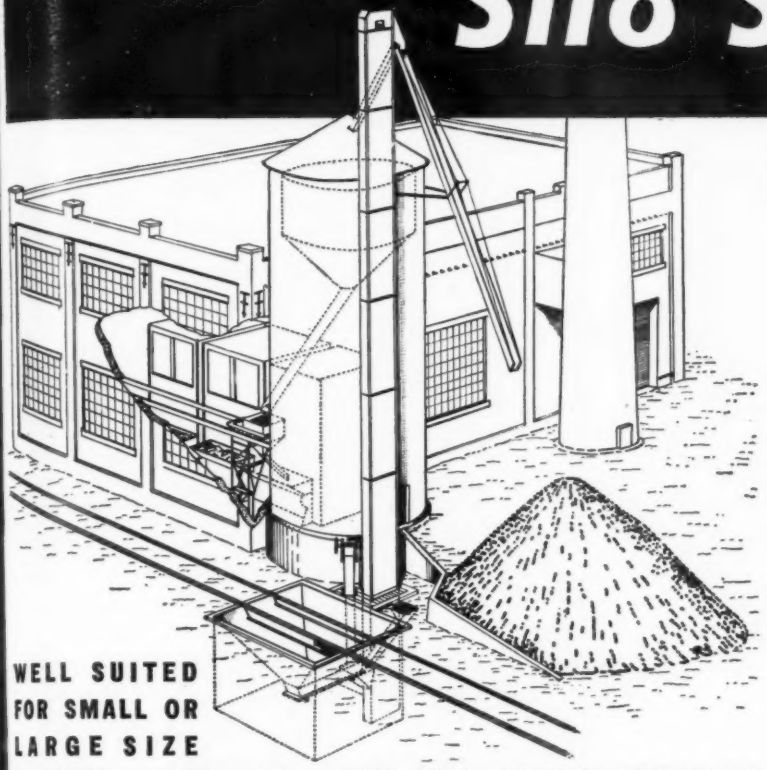
TYPICAL INSTALLATIONS

EEDS & NORTHRUP COMPANY, 4910 STENTON AVE., PHILA., PA.

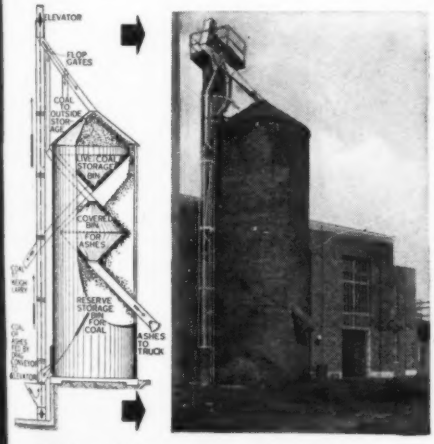
EEDS & NORTHRUP

TS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

COAL AND ASHES HANDLING SIMPLIFIED WITH THE Silo System



WELL SUITED FOR SMALL OR LARGE SIZE PLANTS — NEW OR EXISTING INSTALLATIONS



Both coal and ashes are handled here. Coal may be diverted to ground storage through an auxiliary spout. Ashes are discharged to the ashes section of the silo by means of a control gate and independent spout.

Another typical silo installation handling coal only, but without auxiliary ground storage. Coal from the live storage hopper in the silo is spouted directly to pulverizers located inside the building.

Combines Supply and Handling Functions in One Compact Economical Unit

Usually silos are located adjacent to the boiler house but constructed independently, and equipment within the boiler house consists entirely of means for distributing the coal. Frequently a single spout from the silo is all that is needed. Silos may be designed for normal storage requirements or equipped with an auxiliary spout to provide additional outside reserve storage when desired. This system may be arranged to store both coal and ashes. The installation shown above handles coal only, supplying the boiler house from active and reserve storage within the silo and storing out additional reserve ground storage. A traveling weigh larry receives coal from the live storage hopper of the silo and distributes it to the stokers. Talk over your problems with our experienced engineers.

LINK-BELT COMPANY

Chicago, Indianapolis, Philadelphia, Atlanta, Dallas, San Francisco, New York, Toronto. Offices, warehouses and distributors in principal cities.

2190-A

LINK-BELT

... Coal And Ashes Handling Equipment

CONVEYORS • ELEVATORS • SKIP HOISTS • CRUSHERS • LARRIES • SCREENS

POWER— MORE and

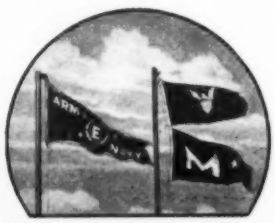
Electric power output has reached an all-time high —and is still moving upward. The increasing demands of industry are being met, as are also those for electricity for domestic use.

The credit for this almost miraculous situation belongs principally to the public utility companies, which in peace time correctly interpreted trends and prepared to meet what were certain to be unprecedented demands on their capacity.

In meeting these demands today, many of the central-stations have the help of newer types of Babcock & Wilcox Boilers, the High-Head, Radiant, Open-Pass, and Integral-Furnace. Each of these types definitely satisfies the requirements of some combination of operating conditions,as is evidenced by the fact that B&W boilers of these types alone in service have a nominal total steam-generating capacity of 42,000,000 lb. per hour.

While we take understandable pride in the performance of our boilers, we feel that to the designers, engineers and operators of the public utilities belongs the real credit for meeting the demands of the industrial and domestic power consumers in this emergency.

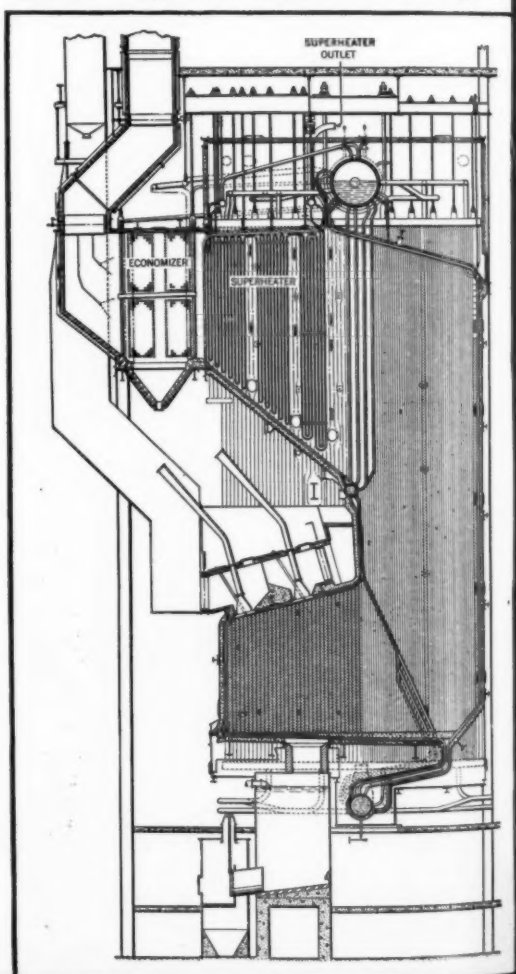
THE BABCOCK & WILCOX COMPANY
85 LIBERTY STREET, NEW YORK, N. Y.



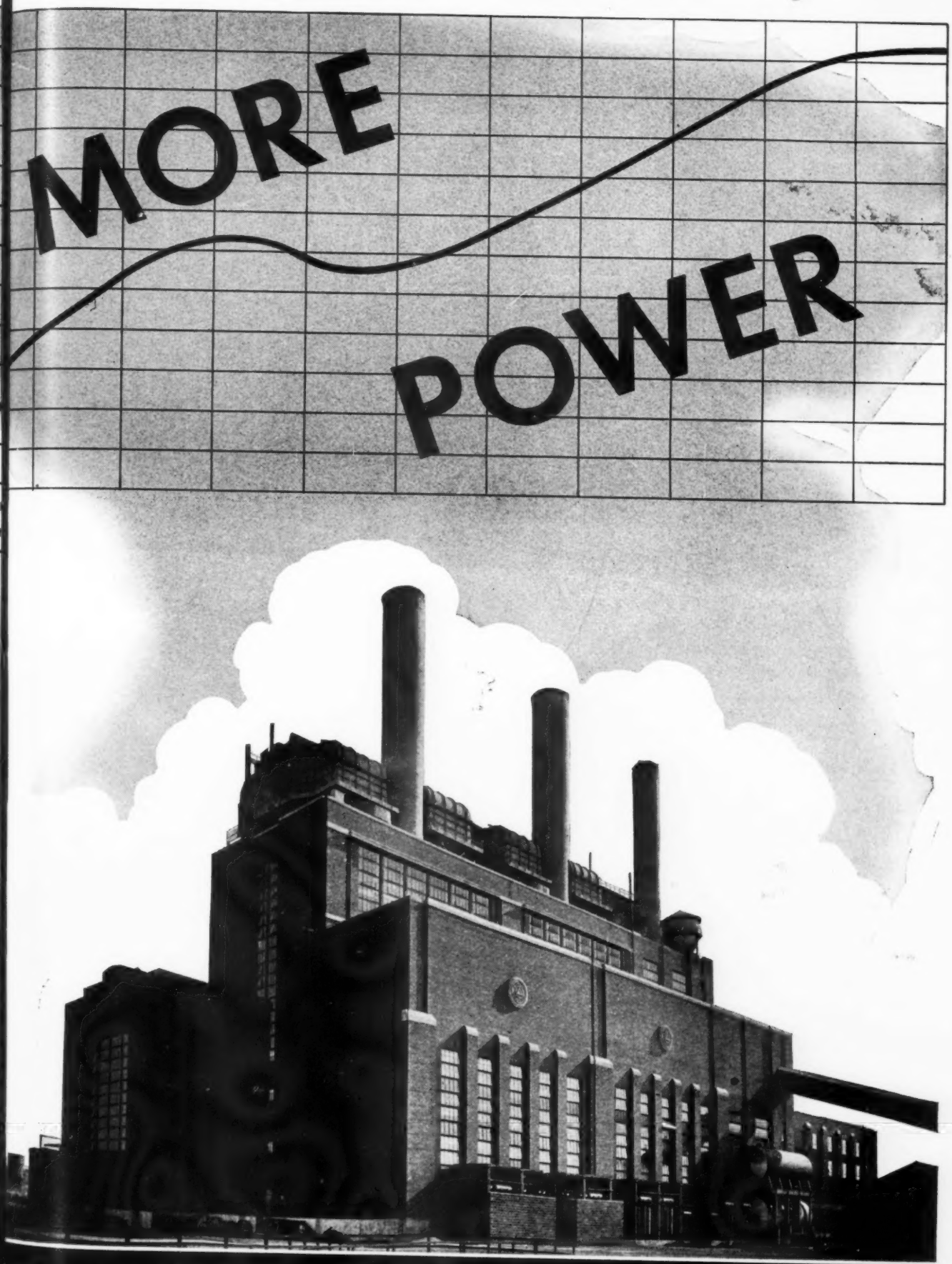
The Army-Navy "E" with two stars and Maritime Commission Award flags are floated proudly at the Barberton Works.

G-250T

Typical B&W Radiant Boiler in Central-Statio Service. Capacity 550,000 lb. steam per h



THE BABCOCK &

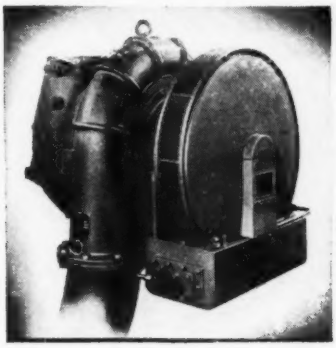


WILCOX COMPANY

277 does not reply"

Nor will it reply, Herr U-Bote Admiral. So when hope has died, cross U-277 off the active list. Send out the usual messages of condolence — "For Fuehrer and Fatherland." Try to keep the bad news away from U-Bote circles, for crews tend to become — well, discouraged.

Meanwhile, here in an East coast seaport, another PC boat commander is decorated, his crew feted, and his active little sub-smasher again takes up her patrol job, "Y-guns" and "ash-cans" ready on the instant, listening devices constantly manned, Diesel engines softly purring, their Elliott turbochargers packing added power into every turn of the screw. For the four-cycle Diesels which drive PC boats, minesweepers, and other patrol craft, in a great number of cases enjoy the increased power, speed and economy of supercharging provided by Elliott-Buchi Turbochargers. To say nothing of the Diesel-driven cargo vessels, Army Quartermaster sea-going tugs, tow-boats, etc., many of which are also equipped with these weight-saving, fuel-saving, power-boosting units. Turbochargers are one of Elliott Company's contributions to Victory.



ELLIOTT-BUCHI TURBOCHARGERS are driven by engine exhaust, with no mechanical coupling. Their speed is automatically controlled by the volume of exhaust, hence always adjusted to the load. They increase efficiency in both scavenging and combustion. Used in stationary as well as marine Diesel engine power plants. Full details at your request.

The Army-Navy "E" has been awarded to both the Jeannette and the Ridgway plants of Elliott Company.

ELLIOTT COMPANY
Supercharger Department, **JEANNETTE, PA.**
DISTRICT OFFICES IN PRINCIPAL CITIES

STEAM TURBINES • GENERATORS • MOTORS • CONDENSERS
FEEDWATER HEATERS AND DEAERATORS • STEAM JET EJECTORS
CENTRIFUGAL BLOWERS • TURBOCHARGERS FOR DIESEL ENGINES
TUBE CLEANERS • STRAINERS • DESUPERHEATERS • FILTERS

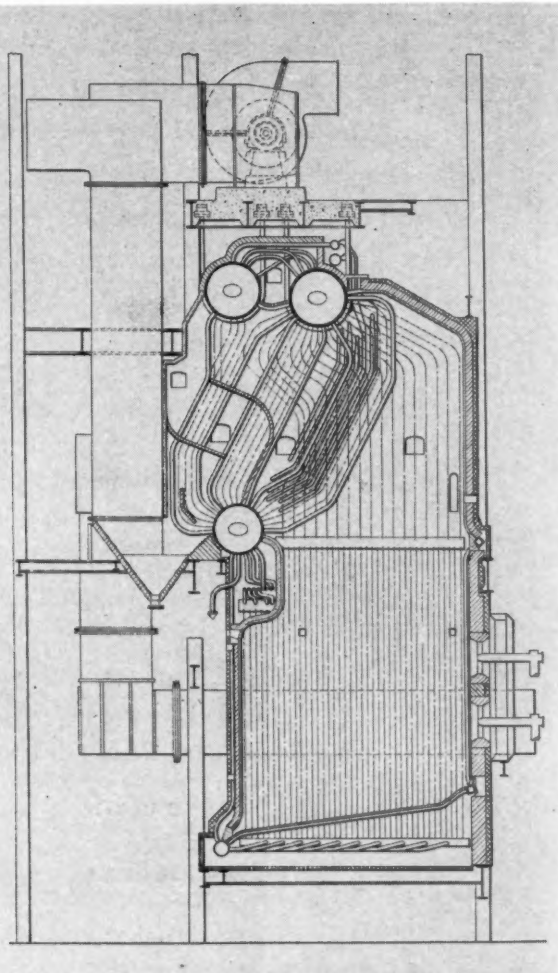
TURBOCHARGERS FOR DIESEL ENGINES BY

ELLIOTT

ONE OF AMERICA'S GREAT BUILDERS OF POWER AND PROCESS EQUIPMENT

M-62

5 years... 2 units...



One of two identical units which were responsible for the performance record described on the opposite page. Capacity—150,000 lb of steam per hr. Design pressure — 660 psi. Total steam temperature — 700 F.

98.2% service!

Here's another industrial record that shows what dependable steam generating equipment can accomplish. In a plant of one of the nation's largest chemical companies there are two C-E steam generating units which have been in service for 98.2% of all the available hours in the five year period from 1938 to 1942 inclusive. In that time the two units together produced a total of 12,250,000,000 lb of steam which is 94% of the maximum potential, or the amount that might have been produced if the units operated continuously at maximum capacity for the entire period.

The consistency of this performance is evidenced by the most recent record . . . during our first year of war . . . when the two units responded to the need for maximum steam generation and reliable performance by operating for 98.9% of all the time in the entire year of 1942. In other words, the C-E units were out of service for all purposes, inspections and repairs to both boilers and accessories, for approximately 1% of the total time.

The uniformity with which C-E units in industrial plants throughout the country continue to meet the war time steam load is evidence of the standards of quality which governed their original design and construction.

A-737

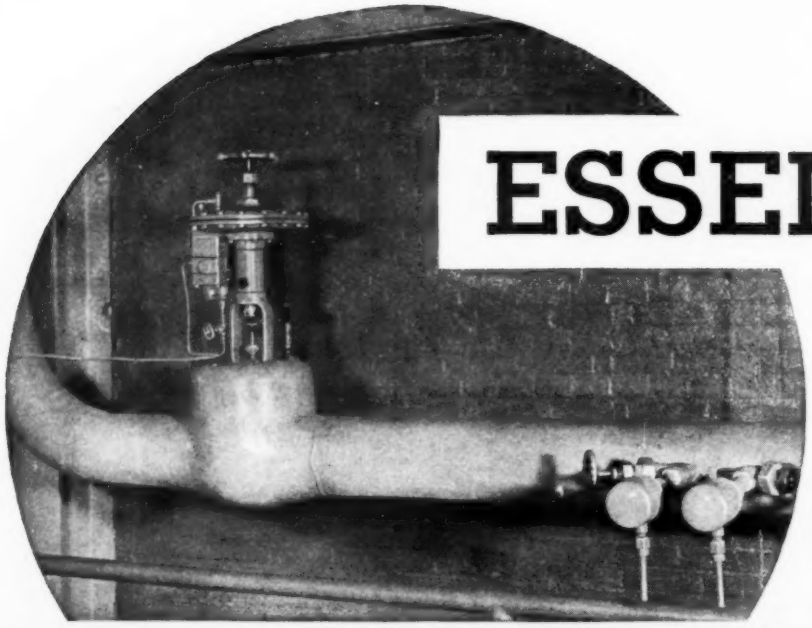
COMBUSTION ENGINEERING

200 MADISON AVENUE, NEW YORK, N. Y.

Canadian Associates

COMBUSTION ENGINEERING CORPORATION LIMITED

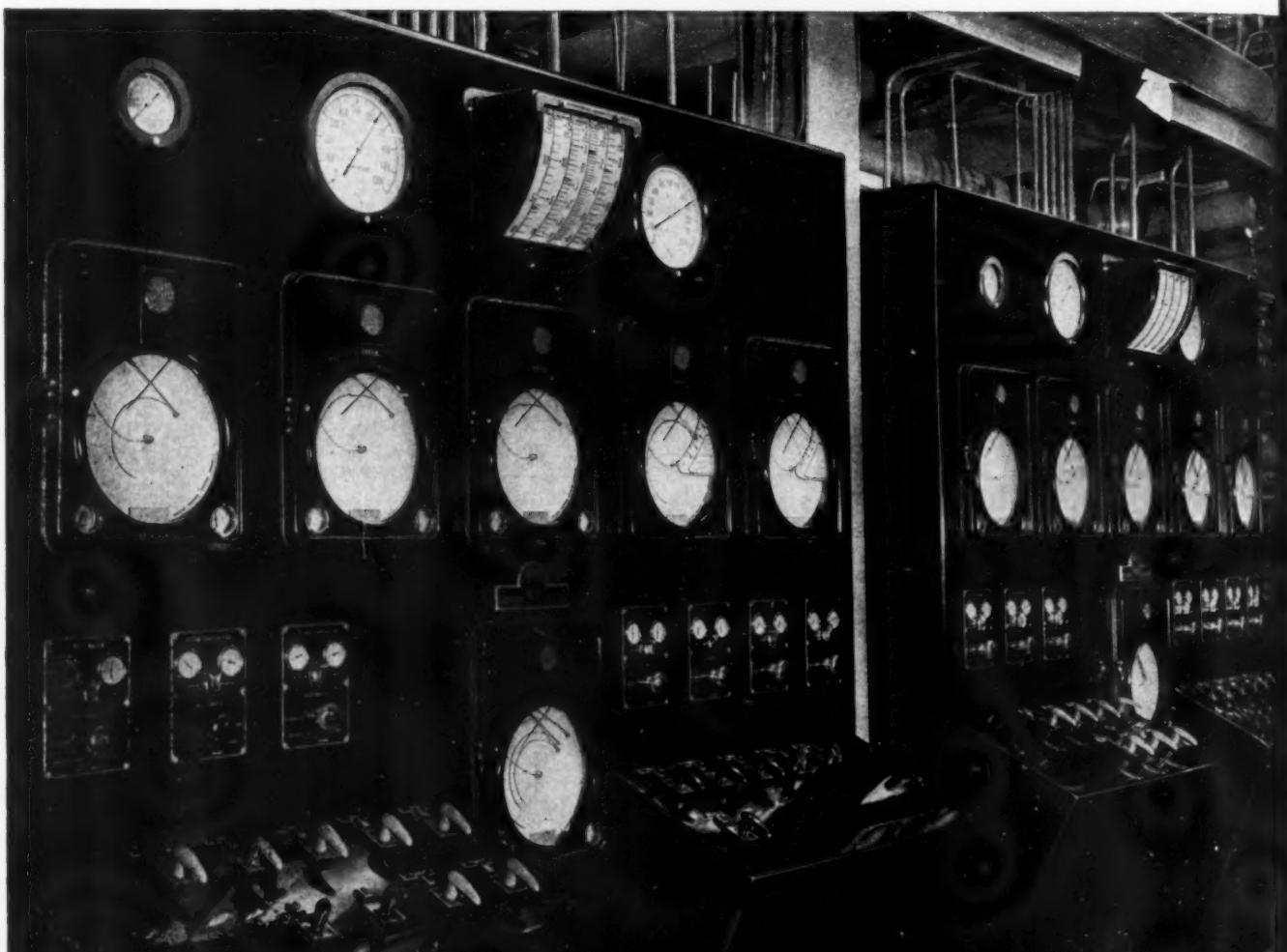
Montreal Toronto Winnipeg Vancouver



ESSENTIAL

Bailey Feed Water Control Va

Bailey Boiler Control Panels for h
135,000 lb. per hour capacity,
and gas-fired boilers in a West
Power Station.



BAILEY METER CONTROL

BOILER METERS • MULTI-POINTER GAGES • FLUID METERS • RECORDERS • SUPERHE

IN *WAR,* PROFITABLE IN *Peace*

Bailey Boiler Control Conserves Fuel, Insures Safety, Increases Turbine Efficiency, Improves Continuity of Service and Simplifies Training of Operators . . . . .

★ The same qualities of Bailey Boiler Control which make it essential in wartime power plant operation, make it profitable to use in peacetime operation.

It conserves fuel and fuel transportation facilities by automatically maintaining the correct fuel—air ratio for efficient combustion at all times.

It insures against accidents to operators and equipment by:

Accurate control of boiler water level, steam temperature and fuel—air ratio.

Interlocks to insure the proper sequence of operation.

Limiting devices to prevent operation under unstable conditions.

Alarms to warn operators of dangerous conditions such as high or low water level, flame failure, loss of air pressure, etc.

It increases turbine efficiency by supplying steam at design pressure and temperature at all times.

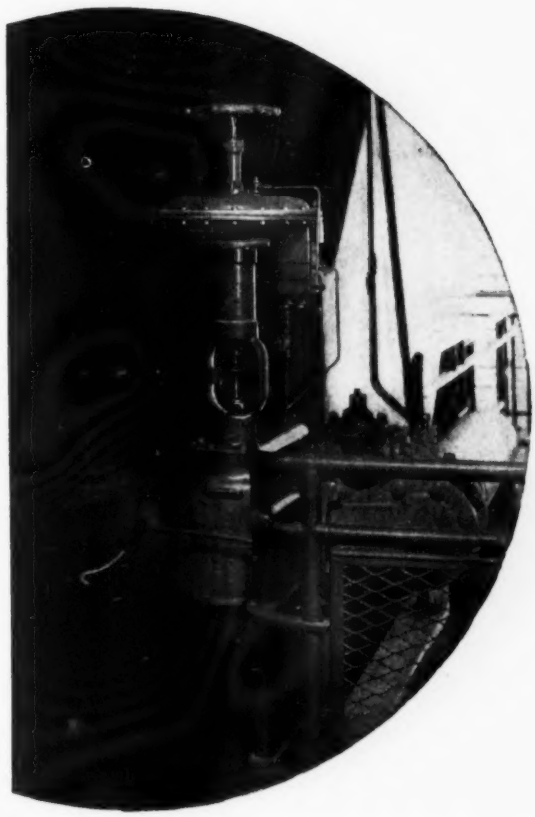
It improves the continuity of service by reducing furnace and boiler repairs.

It simplifies training of new operators and insures continuous economy during the training period.

These same qualities of Bailey Boiler Control which are now helping to win the war will help American industry to win the peace.

Suggestions for wartime boiler plant operation are given in our Bulletin No. 16 "How to Safely Stretch Steaming Capacity." Ask for your copy now.

A-90



Bailey Gas Flow Control Valve.

BAILEY METER COMPANY

1036 IVANHOE ROAD • CLEVELAND, OHIO

Bailey Meter Company Limited, Montreal, Canada

The Complete Combustion Control System

NTROL • DESUPERHEAT CONTROL • COMBUSTION CONTROL • FEED WATER CONTROL

Sturtevant Equipment AND SYSTEMS

REG. U. S. PAT. OFF.

ENGINEERED FOR PRECISION-VENTILATING, HEATING, AIR CONDITIONING, DRYING, DUST AND FUME CONTROL, PNEUMATIC CONVEYING, MECHANICAL DRAFT

...line must be modernized...for 194V

MANY ARE THE PRODUCTS that are "hung out" to dry at some stage on their way to battle. And many are the busy war plants where even the best of existing dryers simply couldn't meet today's exceptional demands for increased production and improved products. Admittedly these were tough problems... but we hung out the "do not disturb" sign on the Sturtevant Research Laboratory and went to work.

The result... an improved dryer with a scientifically designed arrangement of tapered nozzles and baffle plates inside the dryer housing, that produces a change of air up to 300 times a minute near the material, permits perfect control of air flow. The increased output and improved quality which followed this application of Sturtevant engineering skill is exemplified by these recent drying projects:

A rubber dryer, five stories high, to apply and vulcanize rubber sheathing on copper wire in one continuous process... to turn it out in a fraction of the former time and in quantities that, if revealed, would make the Axis quake.

Sulfanilamide and other victory-vital chemicals are now processed in Sturtevant dryers where wet and dry bulb temperatures can be instantly regulated... and constantly adjusted to the requirements of each product. And that means more uniform drying of each batch... capacity increased to handle 2,500 pounds of material at a time... with a 50% reduction in drying time.

Reversible camouflage cloth is now dried in continuous ranges which utilize recirculated air combined with outside air, in just the right proportions. As a result, the cloth is delivered at record breaking speeds of six miles an hour... with valuable savings in fuel for heat.

An improved method of introducing air to contact the surface of such materials as sandpaper and pyroxalin cloth eliminates surface defects... speeds production. In the case of rabbit fur, drying time was cut from 24 hours to 15 minutes, handling as many as 8000 pelts an hour! And for a hundred other products, there are a hundred other reasons why Sturtevant Dryers went to work... to turn out war goods faster, more efficiently. Reasons that will be equally important to *every manufacturer* when industry competes for post-war markets.

ENGINEERED AIR will make a difference...

Yes, air that is engineered to serve efficiently—not only in drying but in all phases of industrial air conditioning, heating, ventilating, dust and fume control, pneumatic conveying and mechanical draft—will make the difference between profit and loss in many a plant when industry returns to a highly competitive stage. With new war-won knowledge, Sturtevant is in a position to find the most efficient and economical solution to your approaching problems. Why not call in a Sturtevant expert now and let him consult with your post-war planning committee, and show them how correct engineering can improve the quality of your post-victory products and save time and money in their manufacture?

B. F. STURTEVANT COMPANY

Hyde Park, Boston, Mass. *Branches in 40 Cities*

B. F. Sturtevant Company of Canada, Ltd., Galt, Toronto, Montreal

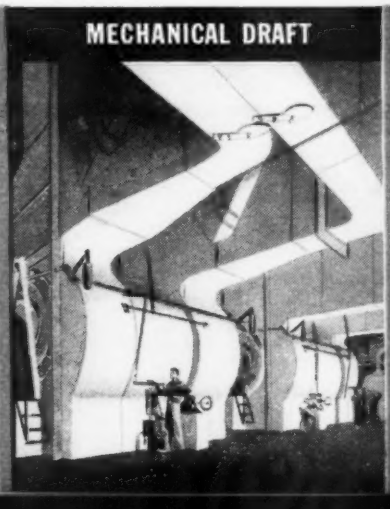
Facts you want about drying today

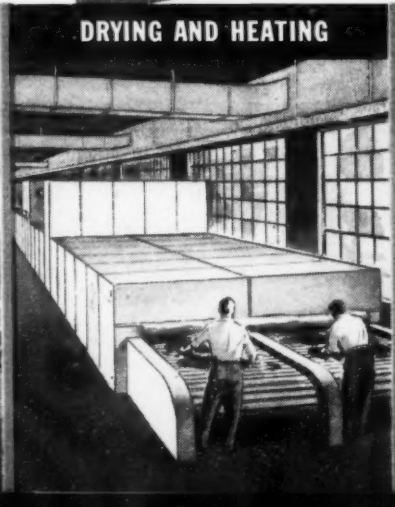
If you are a plant engineer or industrial executive, you will want to investigate the recent progress in evaporative drying. This new 28 page Sturtevant Catalog #461 discusses the various methods of moisture removal, describes the types of air dryers, shows photos and gives operating data on a wide variety of installations. Write for your copy today.

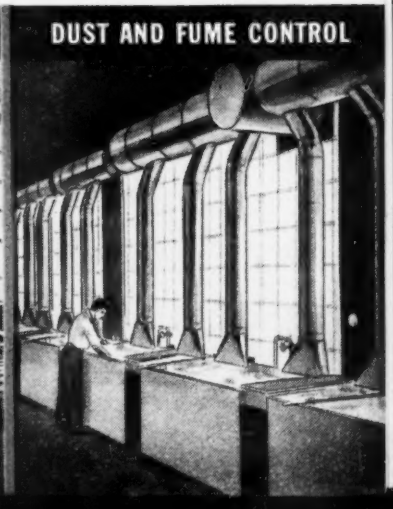
Sturtevant

REG. U.S. PAT. OFF.

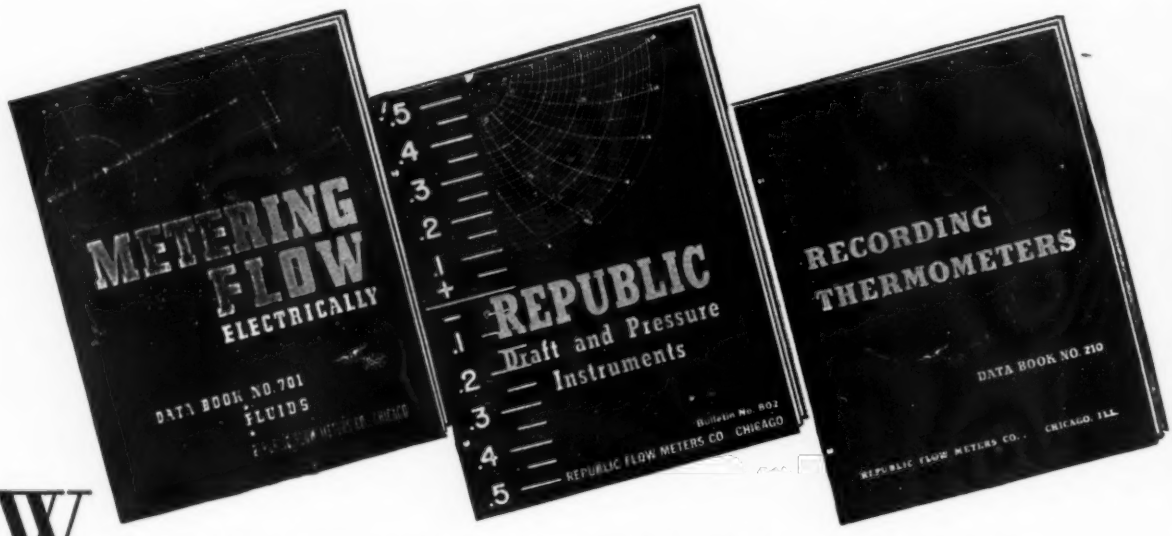
Puts Air to Work







THESE
Data Books
WILL HELP YOU
SOLVE YOUR POWER PROBLEMS



WRITE for these data books now! They are filled with important power plant data generally difficult to locate. When your increased power load demands the installation of new units or the "stretching" of existing plant capacity, you will need this information.

REMOTE READING FLOW METERS — Data Book No. 701

For measuring flow of steam generated by each boiler and the total produced; steam consumed by prime movers and process steam consuming units; water supplied to boilers and pumped to processes; rate of generation, distribution and consumption of natural gas, coke oven gas, compressed air and the like; flow of fuel oil, brine, black liquor and so on; the Republic electrical type flow meter with remote reading instruments, as described in this book, is available.

MECHANICAL FLOW METERS — Bulletins No. 110 and No. 311

When it is desired to measure flow of steam, water, gas, air or oil for the same purposes as outlined above but where remote registration is not required, the Republic mechanical meters described in these books are available.

DRAFT AND PRESSURE INSTRUMENTS — Bulletin No. 802

Proper regulation of draft is one of the most important requirements in obtaining highest combustion efficiency. For indicating and recording drafts, pressures and differentials, Republic indicators and recorders, described in detail in this bulletin, are supplied in any desired combination for all ranges encountered in furnace operation.

REPUBLIC INSTRUMENTS AND CONTROLS

RECORDING THERMOMETERS — Data Book No. 210

Measurements of temperature of flue gas, temperatures in vats or tanks, pipe lines, refrigeration systems, ovens, kilns or ducts and so on, are vital in maintaining highest capacity and efficiency in power plant and process equipment. Republic recording thermometers for this service are described in this data book.

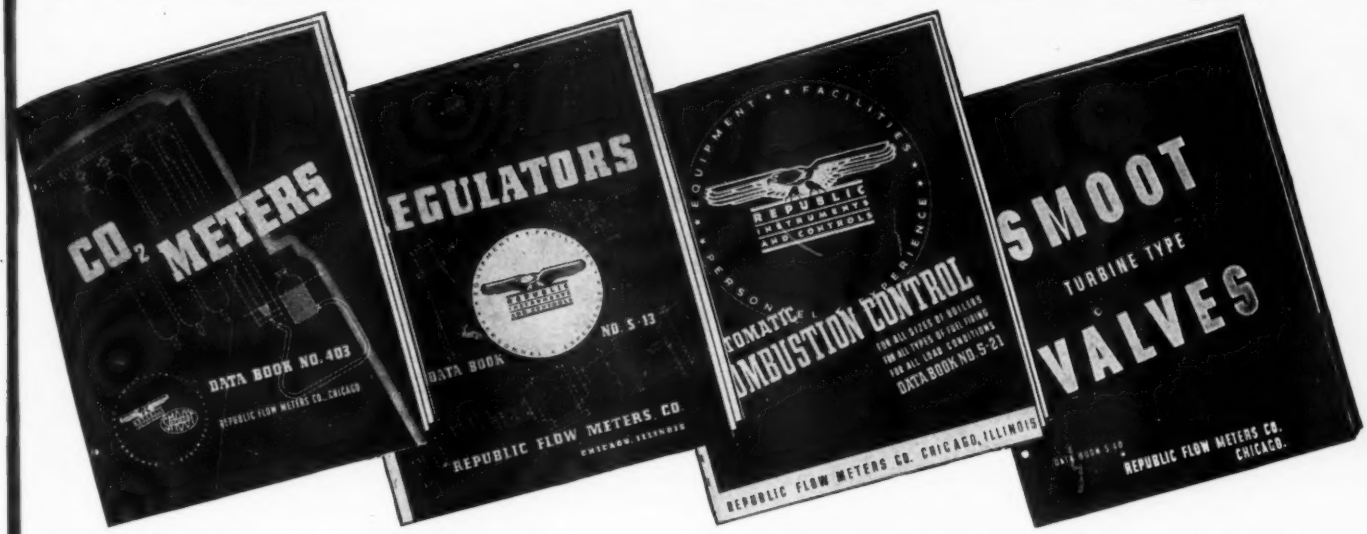
CO_2 METERS — Data Book No. 403

For every fuel and boiler, there is a definite percentage of CO_2 in the flue gas that will assure highest combustion efficiency. The CO_2 meter is the most practical method of determining combustion efficiency. The construction and operation of the Republic CO_2 meter are described in detail in this book.

Republic-Smoot automatic combustion control systems are built for all sizes of boilers, all types of fuel firing and all load conditions, as described in this book, which includes detailed installation reports giving performance data on outstanding power plants.

REGULATING VALVES — Data Book No. S-40

In any plant generating high-pressure, high-temperature steam, there are key valves doing tough jobs in controlling flows or pressures on which vital operations depend — pressure reducing valves co-ordinating high and low pressure steam systems, feedwater valves on 1500 lb. boilers. For such tough jobs, where responsibility, long life and accurate regulation count most and failure must not occur, the Republic-Smoot valves described in this bulletin have been designed.



REGULATORS — Data Book No. S-13

Control of rate of flow of liquids and gases, level of liquids, speed of turbines, engines and motors and proportions between variable pressures and flows must be accurate if maximum plant efficiency is to be attained. These factors are controlled by operation of valves, dampers, rheostats, etc. For sensitive, fast, stable and powerful automatic control of these devices, the Republic-Smoot regulator has been developed. Its construction, operation and applications are described in this book.

AUTOMATIC COMBUSTION CONTROLS — Data Book No. S-21

Boilers must produce maximum steam output at maximum efficiency. That means constant steam pressure, maximum combustion efficiency, constant and correct furnace draft, desired load division among boilers.

DESUPERHEATERS — Data Book No. S-35

In the modern power plant, steam temperatures in interconnected systems — topping turbine bypasses, tie lines, turbine exhaust lines and process steam headers — must be accurately controlled by desuperheaters. For such exacting services, the Republic-Smoot desuperheaters described in this book are employed.

★ ★ ★ ★

Republic Flow Meters Co. offers a complete manufacturing and engineering service in the field of measurement and control. We will be glad to co-operate with you in the solution of any metering or control problem, whether it involves a single instrument or the automatic control of an entire process or plant. Your inquiries will involve no obligation on your part.

Republic Flow Meters Co.

2222 Diversey Parkway • Chicago, Illinois

How to Straighten a Warped Soot Blower Element

Soot Blower Elements—the pipe sections with nozzles within the boiler—meet such severe service conditions that they sometimes become badly distorted. Wartime difficulty in obtaining replacements quickly makes it important to know how to straighten distorted elements with minimum risk of breakage.

Diamond elements are made in three types for various temperatures:

Plain Elements—made from extra heavy seamless steel tubing with the distal ends closed by spinning. Venturi type nozzles are electrically welded into the tubing. They can be readily recognized as steel tubes.

Calorized Elements—made from extra heavy or double extra heavy seamless steel tubing with the distal end closed by spinning, and Venturi type nozzles electrically welded into the tube walls are then impregnated with aluminum both inside and outside. They can be recognized by their bright appearance.

Dialoy Elements—made from seamless chrome iron tubing having a very high percentage of chromium. The distal ends are spun closed and Venturi nozzles are formed by building up a pad of alloy on the outside of the tube and drilling the nozzle through the pad and tube wall. Dialoy elements may be recognized by these welded pad nozzles and their yellow painted distal end.

Straightening Elements—If an element is not too badly distorted and the bearings are in proper alignment, it is frequently possible to straighten the element without removing it from the boiler. This is done by turning it to the point where it binds hard in the bearings and then leaving it in this position for a few hours.

If the element is so badly distorted that this method does not straighten it, remove it from the boiler.

Heat Calorized and plain steel elements to a cherry red (about 1500° F.) and then lay on a level floor or other surface. A wooden block should then be used to tap out the bent sections. The entire element should be heated at one time if at all possible; if not, the bent sections may be heated separately.

Dialoy elements should be heated to about 1650° F. (between a bright red and orange) and the same straightening process used as for Calorized and steel elements. After straightening, Dialoy elements should be quenched in water. If they cool considerably while being straightened, they should be reheated to 1650° F. and then quenched. Quenching of high chromium alloys softens or anneals the metal.

DIAMOND POWER SPECIALTY CORP., Detroit, Michigan

DIAMOND SPECIALTY LIMITED · Windsor, Ontario

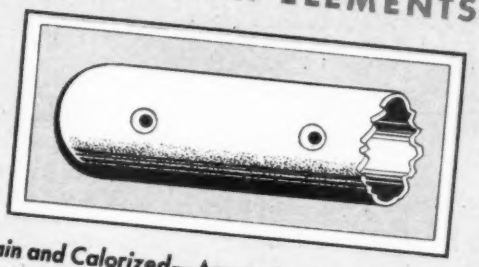
Diamond Soot Blowers Have Been "Drafted"

Careful Treatment Will Prolong the Life of Those You Have

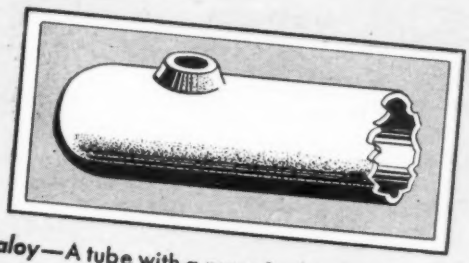
Almost the entire production of the Diamond plant is "drafted"—earmarked for war production. Hence, it is to your interest to make the soot blowers you have last as long as possible.

This is the second of a series of advertisements telling you how to do it. Send for a copy of the booklet on the care and maintenance of Diamond Soot Blowers.

THREE KINDS OF BLOWER ELEMENTS



Plain and Calorized—A smooth tube with a row of welded holes (nozzles) is either a plain or calorized element.



Dialoy—A tube with a row of pads through which nozzles are drilled is a Dialoy element.

HEAT FOR STRAIGHTENING

Heat plain and Calorized elements to 1500° F.—cherry red.

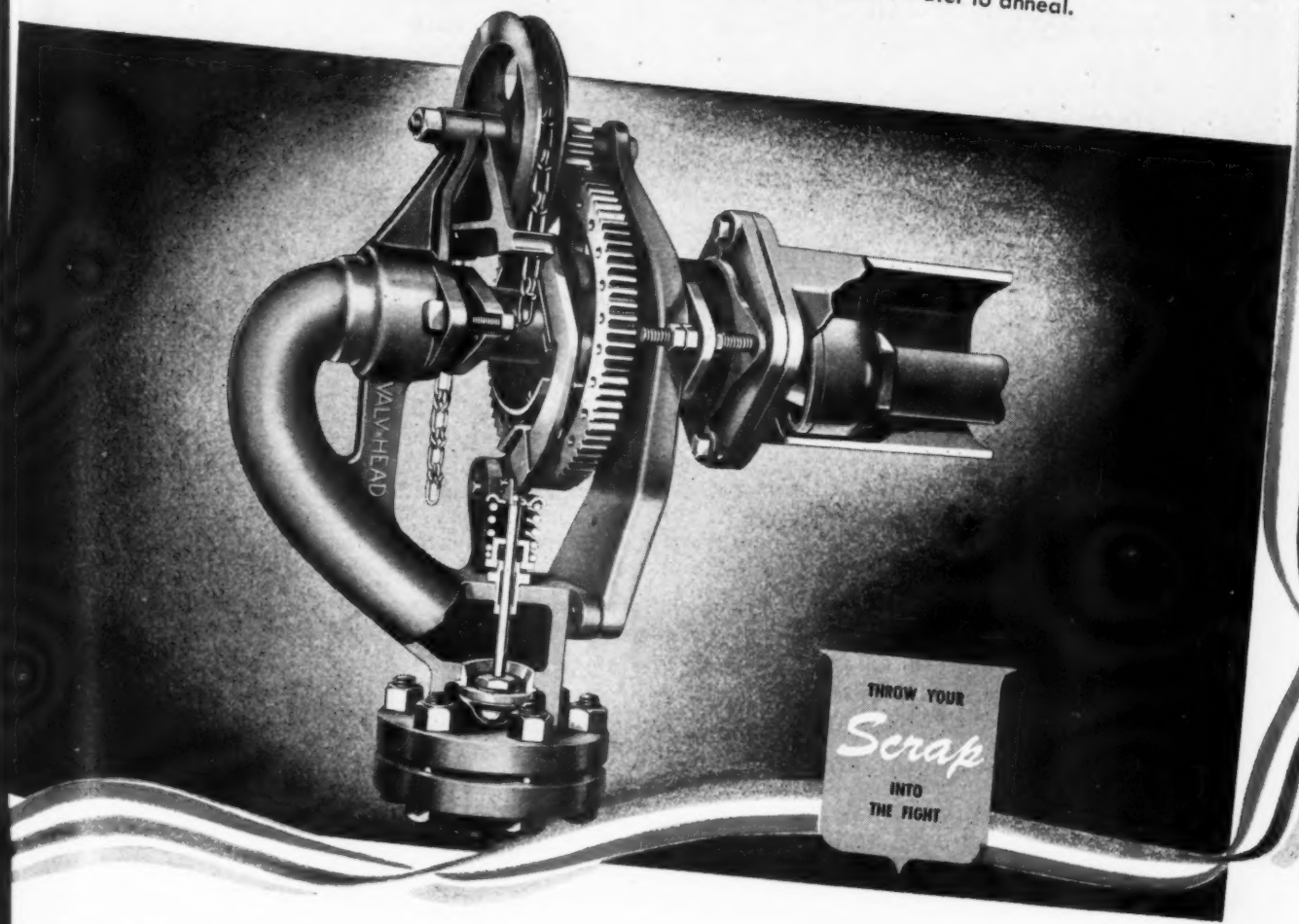
Heat Dialoy elements to 1650° F.—between bright red and orange.

ROLL ON FLAT SURFACE TO STRAIGHTEN

Tap at warped places with a wooden block. If the element cools considerably before straightening is complete, it should be reheated.

DIALOY ELEMENTS ONLY

Should be quenched in water to anneal.



1 Pill for 9 Headaches!

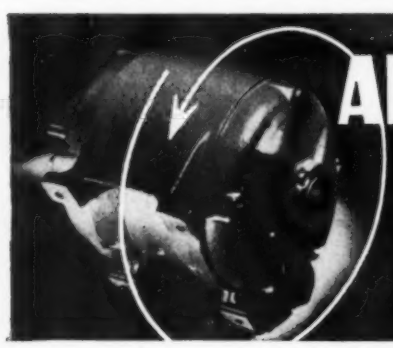
PAGES FROM "A GUIDE TO WARTIME CARE OF ELECTRIC MOTORS"

Electric Motor Enemy No. 1...
DUST
Electric Motor Enemy No. 2...
STRAY OIL
OIL IS QUICK TO ATTACK INSULATION WHEN IT REACHES IT.
Electric Motor Enemy No. 3...
MOISTURE
Electric Motor Enemy No. 4...
FRICTION
Electric Motor Enemy No. 5...
MISALIGNMENT
Electric Motor Enemy No. 6...
VIBRATION
VIBRATION SHAKES THE LIFE OUT OF MOTORS
Electric Motor Enemy No. 7...
UNEVEN WEAR
Electric Motor Enemy No. 8...
OVERLOAD
LIKE AN OVERLOADED HORSE, A MOTOR WORKED BEYOND IT'S HORSEPOWER CAPACITY IS SURE TO "BREAK DOWN".
Electric Motor Enemy No. 9...
UNDERLOAD

ALL NINE electric motor enemies are present and accounted for in Allis-Chalmers' new "Guide to Wartime Care of Electric Motors." Streamlined instructions and story-telling pictures describe what they are, where they're found, how to fight them.

Designed for wartime U. S. industry, "Guide to Wartime Care of Electric Motors" has aroused such world-wide demand that Spanish and Portuguese editions are now printing!

You'll find this valuable new handbook ideal both for training new men and "brushing up" old hands. It contains no advertising. Write today for *your* free copy of this tremendously successful handbook to ALLIS-CHALMERS MFG. CO., MILWAUKEE, WISCONSIN. A 1625



ALLIS-CHALMERS MOTORS

When you do need new motors, look into the strength, solidity and all-around protection of the new "Safety Circle"—protected top, sides, ends and bottom.

A-C WE WORK FOR VICTORY WE PLAN FOR PEACE

SHAW PRE-FABRICATED PIPING

Is helping knock-out the axis

At the Shaw plant we are expending our full effort to help produce Piping needed in the processing of Explosives, Synthetic Rubber, Destroyer Escort Vessels, and 100 Octane Aviation Gasoline . . . four elements vitally essential to the war effort.

Thus, our employees working on the home front are in this way making their contribution toward final victory.

President

BENJAMIN F. SHAW COMPANY

2nd & Lombard Streets **Wilmington, Delaware**

50th Anniversary Year

TAYLOR STOKERS—
naturals for "catch-as-catch-ca
coal buying

THE WAR has tossed into your lap the problem of buying coal wherever you can—and burning it. Taylor Stokers have the answer to this problem, as well as others. One mid-west Taylor-Stokered plant reports burning 39 different coals successfully in 1942—16 in a single month! These coals varied from 11,232 B. T. U. to 12,000 B. T. U. per pound as fired. Many were from strip mines.

This company, incidentally has placed repeat orders for Taylor Stokers 12 times and uses both air and water cooled types. One unit, placed in service last year, is illustrated on the opposite page.

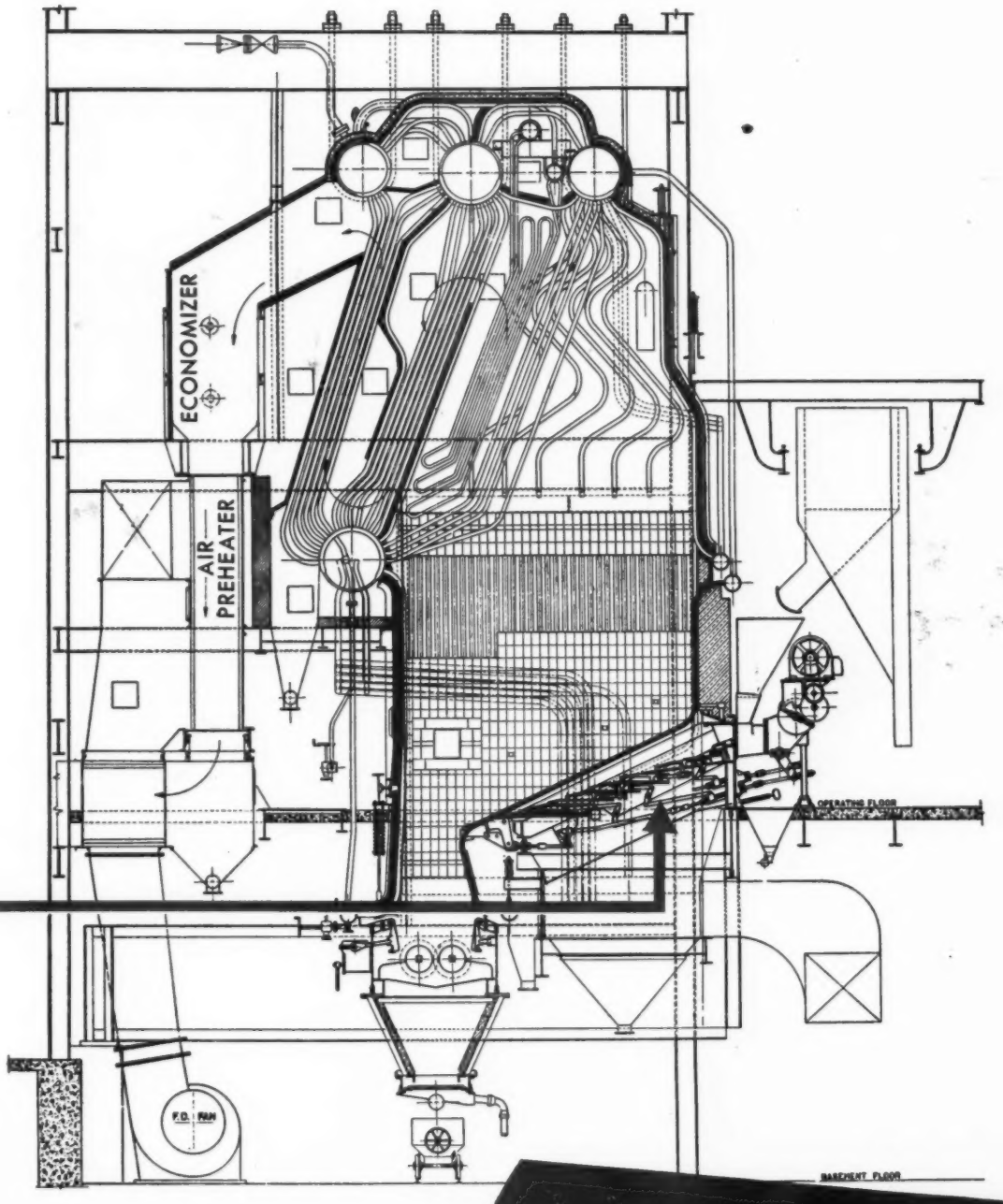
Once again, in war as in peace, Taylor Stoker fuel flexibility pays off handsomely.

JUDGE THE SELECTION OF FUEL FIRING EQUIPMENT BY THESE TWELVE POINTS

1. **RELIABILITY**— the ability to operate with minimum outage and minimum standby equipment.
2. **CAPACITY**— the ability to provide adequate prime capacity ratings, with sufficient reserve capacity for emergencies.
3. **MAINTENANCE**— the ability to operate continuously with minimum repair costs.
4. **FLEXIBILITY**— the ability to follow the steam demand upward or downward . . . quickly and without sacrificing efficiency.
5. **EFFICIENCY**— the proved **dollar** efficiency (**total** cost of steam production) as shown by actual performance in similar installations.
6. **OPERATION**— the ability to operate continuously, the number and type of operations required, the ease of combustion adjustments, etc.
7. **ADAPTABILITY**— the ability to meet special and limiting conditions, present and future—structural limitations, utilization of present equipment, growth and change of power service demands.
8. **FUEL FLEXIBILITY**— the ability to burn efficiently and easily fuels from many sources having widely varying characteristics.
9. **REFUSE DISPOSAL**— the ability to economically eliminate ash or refuse and the opportunities of disposal at low cost, no cost, or profit.
10. **STACK DISCHARGE**— the practical elimination of "smoke nuisance" without special equipment.
11. **SPACE REQUIREMENTS**— the ability to conform to existing or future space limitations, to short and wide or long and narrow furnaces. Also the accessibility of component parts for maintenance and operation.
12. **OBSOLESCENCE**— the adaptability of the equipment toward possible future modernization with minimum of complication and outage.

AMERICAN ENGINEERING

PHILADELPHIA • PENNSYLVANIA



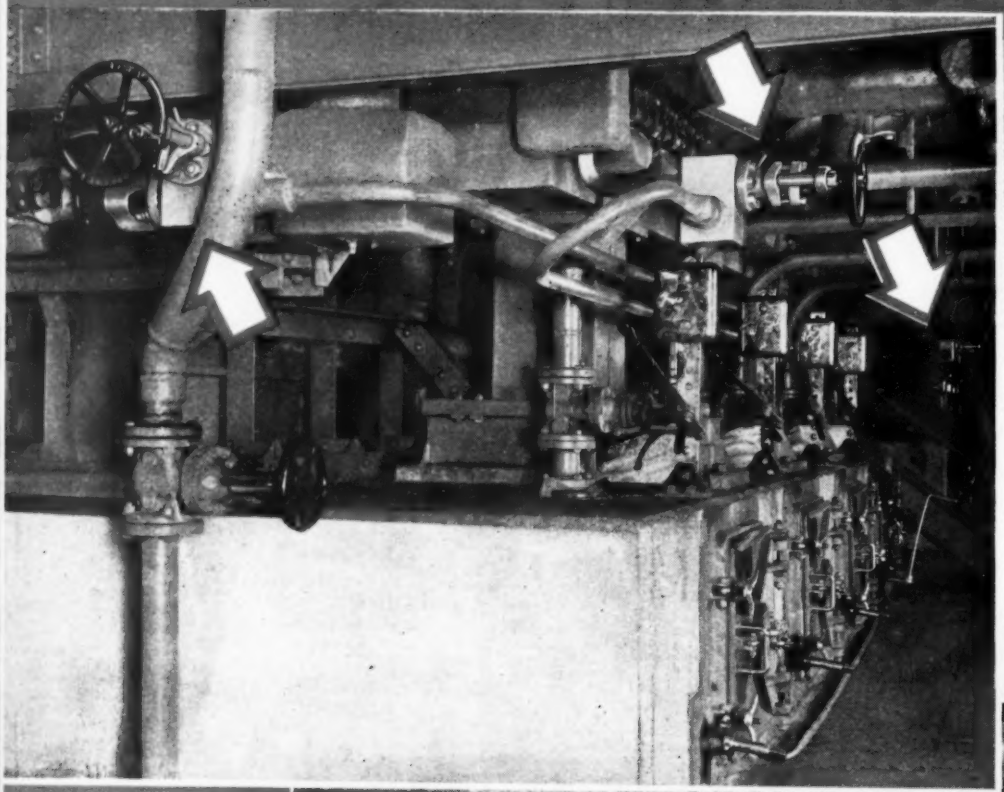
A-E-CO TAYLOR STOKERS
LO-HED HOISTS
HELE-SHAW FLUID POWER
MARINE DECK AUXILIARIES

A-E-CO TAYLOR STOKER

COMPANY

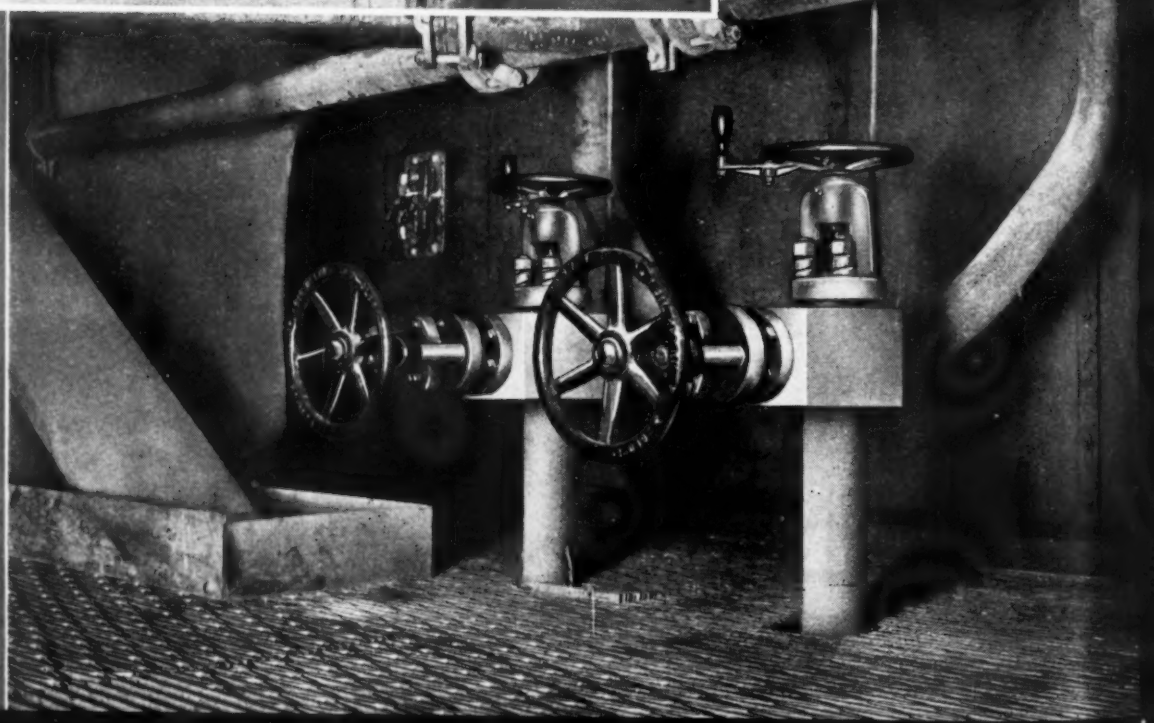
AE CO 75th ANNIVERSARY

YARWAY



Above: Yarway Unit Tandems on Water Wall Drains at West Reading Station of the Metropolitan Edison Co. There are 4 sets of these Tandems used—two sets on each of the two Boilers in the New Addition to this plant. These valves are used to drain the water walls only when the installation is periodically shut down for maintenance.

Below: Two of the four sets of Yarway Unit Tandems on the two new Boilers at West Reading Station. These valves are used to blow down the lower drums about once per week.



YARWAY

at West Reading

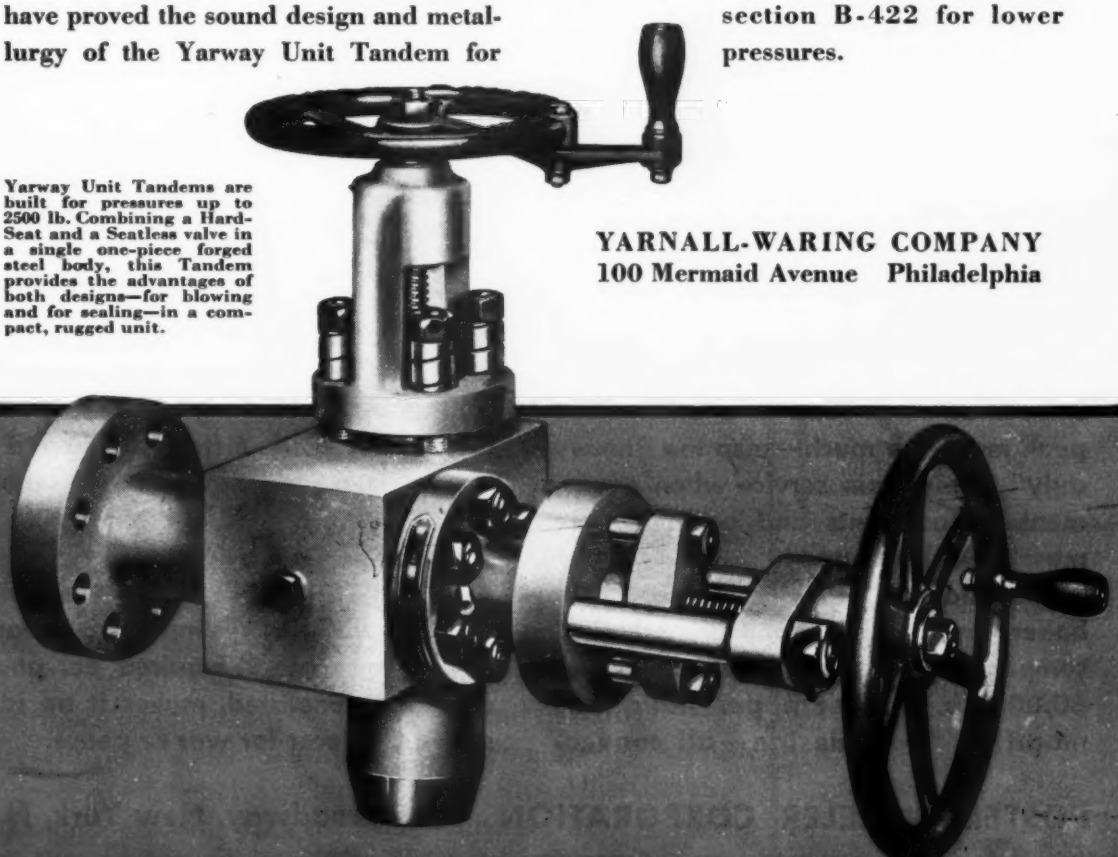
Yarway Unit Tandem Blow-Off Valves Serve this 1400 lb, 900° Station Addition

ANOTHER in the long list of modern high pressure generating stations to select Yarway Unit Tandems for both water wall drains and boiler blowdown lines—the West Reading Station of the Metropolitan Edison Company. (Designing Engineers, Gilbert Engineering Co., Reading, Pa.)

Years of service in the highest pressure plants of leading utilities and industrials have proved the sound design and metallurgy of the Yarway Unit Tandem for blowing down or draining and sealing.

Such records as—"3000 blows at pressures of more than 1300 psi without a single replacement of parts or repairs of any nature"—have made this tandem the outstanding preference for high pressure blow off and draining service, today.

What are your draining and blowdown requirements? Write for Catalog. Section B-431 for pressures up to 2500 lb; section B-422 for lower pressures.



Yarway Unit Tandems are built for pressures up to 2500 lb. Combining a Hard-Seat and a Seatless valve in a single one-piece forged steel body, this Tandem provides the advantages of both designs—for blowing and for sealing—in a compact, rugged unit.

YARNALL-WARING COMPANY
100 Mermaid Avenue Philadelphia

BLOW-OFF VALVES

15,000 lb. EXCESS STEAM for Chemical Company

Upper portion of "S-A" boiler furnace showing water cooled rear wall and divided tube banks.

Reserve capacity in steam generators is doubly important today when ability to carry that extra load and unexpected peak means so much—also the "heavy duty" to maintain service when equipment replacements and additions are most difficult to make.

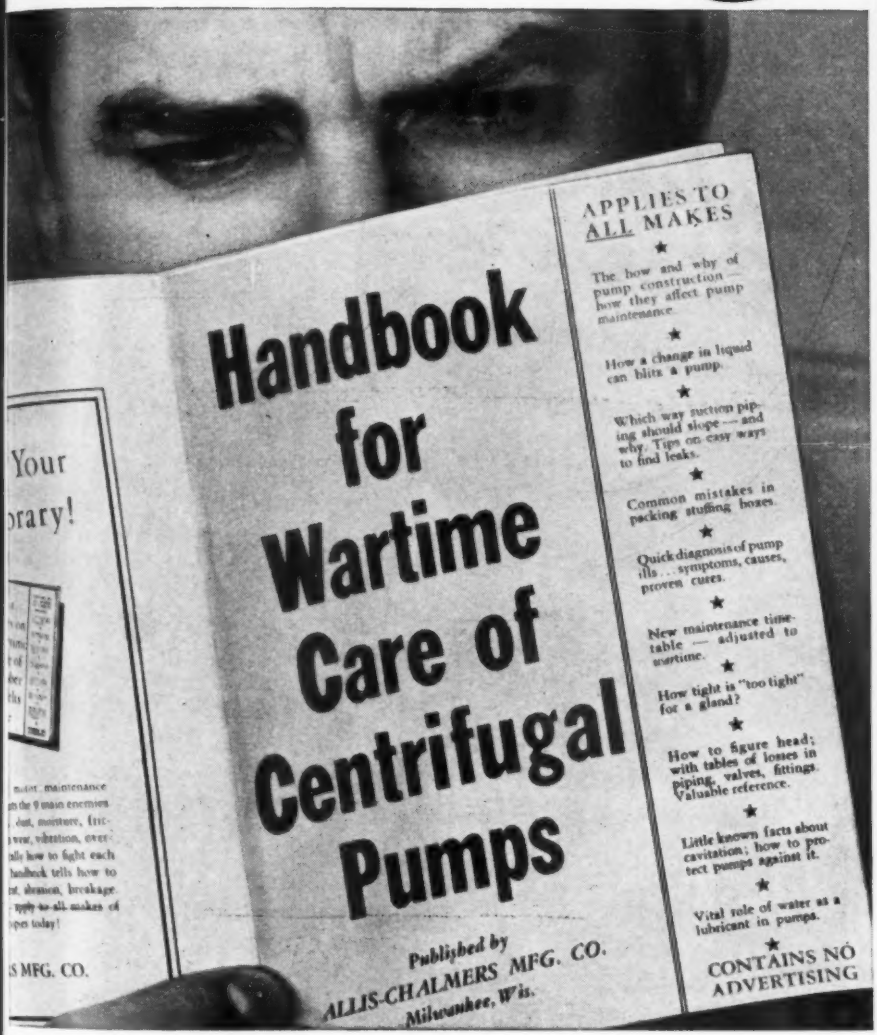
The "bonus" capacity of this "S-A" boiler has stood a prominent chemical company in good stead. Designed for 80,000 lb. of steam per hour, this modified "S-A" design—all convection heating surface placed on one side of furnace—has been operating effectively at from 90,000 to 95,000 lb. steam per hour. Fifteen thousand lb. "extra" steam per hour from unit shown above helps the all-out production effort of American industry.

This characteristic of "S-A" design, coupled with the all important factor of moderate material required per pound of steam generated, makes it an ideal steam producer for war or peace.

FOSTER WHEELER CORPORATION 165 Broadway, New York, N. Y.

FOSTER FW WHEELER

Required Reading!


Handbook for Wartime Care of Centrifugal Pumps
APPLIES TO ALL MAKES
The how and why of pump construction — how they affect pump maintenance.
How a change in liquid can blitz a pump.
Which way suction piping should slope — and why. Tips on easy ways to find leaks.
Common mistakes in packing stuffing boxes.
Quick diagnosis of pump ills . . . symptoms, causes, proven cures.
New maintenance timetable — adjusted to wartime.
How tight is "too tight" for a gland?
How to figure head; with tables of losses in piping, valves, fittings. Valuable reference.
Little known facts about cavitation; how to protect pumps against it.
Vital role of water as a lubricant in pumps.
CONTAINS NO ADVERTISING
Published by ALLIS-CHALMERS MFG. CO. Milwaukee, Wis.

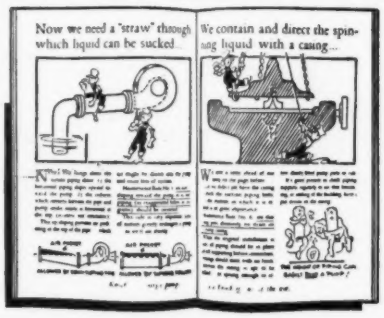
Your copy is free! Allis-Chalmers will gladly mail copies of "Handbook for Wartime Care of Centrifugal Pumps" *free of charge*. It applies to *all* makes — contains no advertising. Use it to make present pumps last — and when you *do* need new pumps, look into the extra efficiency and long life built into Allis-Chalmers centrifugal pumps . . . all types for every purpose.

ALLIS-CHALMERS
MILWAUKEE

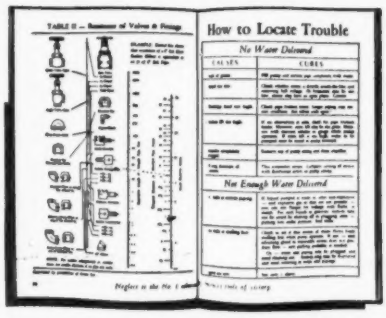
WE WORK FOR VICTORY — WE PLAN FOR PEACE

PUMPS NOW DO 4 TIMES THEIR NORMAL WORK - NEED THE FINER KIND OF CARE SET FORTH IN ALLIS-CHALMERS' NEW HANDBOOK!

EVERY EXECUTIVE, engineer and operating man should have a copy of this important new publication in his technical library. Pumps doing wartime work (8700 instead of 1800 hours a year) need *wartime care!*



To make principles of pump maintenance crystal-clear a pump is *built!*



Contents include valuable tables of friction losses, a guide to locating trouble, a maintenance timetable geared to *wartime!* Get *your* copy!

ALLIS-CHALMERS MFG. CO.
Milwaukee, Wisconsin

Gentlemen:

Yes, I would like to receive *free of charge* a copy of your "Handbook for Wartime Care of Centrifugal Pumps".

(Name)

(Title)

(Company)

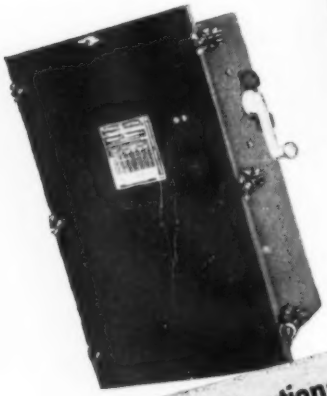
(Street Address)

A 1583 A (City and State)

GENERAL ELECTRIC RECOMMENDS

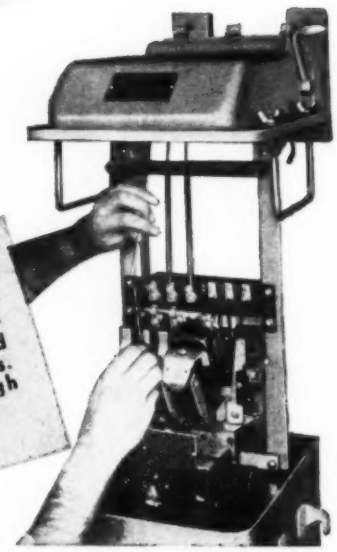
Combination Starters

Instead of Separately Mounted Motor-circuit Switches and Starters



Dust-tight Combinations. For extremely dusty locations. Available through NEMA Size 5.

General-purpose Type. For indoor installations where atmospheric conditions are normal. Available through NEMA Size 5.



For Corrosive Locations. Oil-immersed. Two forms—for both corrosive and hazardous locations. Available through NEMA Size 5.

New High-voltage Combination. Recently developed—provides split-cycle, short-circuit protection and starting means for 2300- and 4000-volt motors.

COMBINATION STARTERS for motors from 1 to 1000 hp

cause . . . they save vital materials

By buying both the motor-circuit switch and the magnetic starter as one compact unit, you save the copper wire, steel conduit, and fittings that are necessary for installing two separately mounted devices—plus the saving gained by using only one steel enclosure instead of the two individual cases required for separate controls.

cause . . . they can be installed easily by "green" crews

G-E combination starters eliminate one complete mounting job on every installation—a time saving of up to 50 per cent. They are completely wired at factory, so all you need do is to connect power, motor, and control leads—saving up to 40 per cent in wiring time.

cause . . . they reduce costly accidents

Combining the motor-circuit switch in the same case with the magnetic starter makes it possible to mechanically interlock the switch with the door so that the door cannot be opened while the power is on. (With separate devices, there is nothing to prevent the operator from opening a case on a "live" starter.)

Write for these Bulletins

CR7008 FULL-VOLTAGE MAGNETIC COMBINATION STARTERS —BULLETIN GEA-3715

NEW SIMPLIFIED GUIDE TO THE SELECTION AND APPLICATION OF COMMONLY USED MOTOR CONTROL —BULLETIN GEA-4015

General Electric Company, Section A 676-94 Schenectady, N. Y.

Please send me the publications checked below.

☐ **COMBINATION STARTERS—GEA-3715**

☐ **SIMPLIFIED GUIDE—GEA-4015**

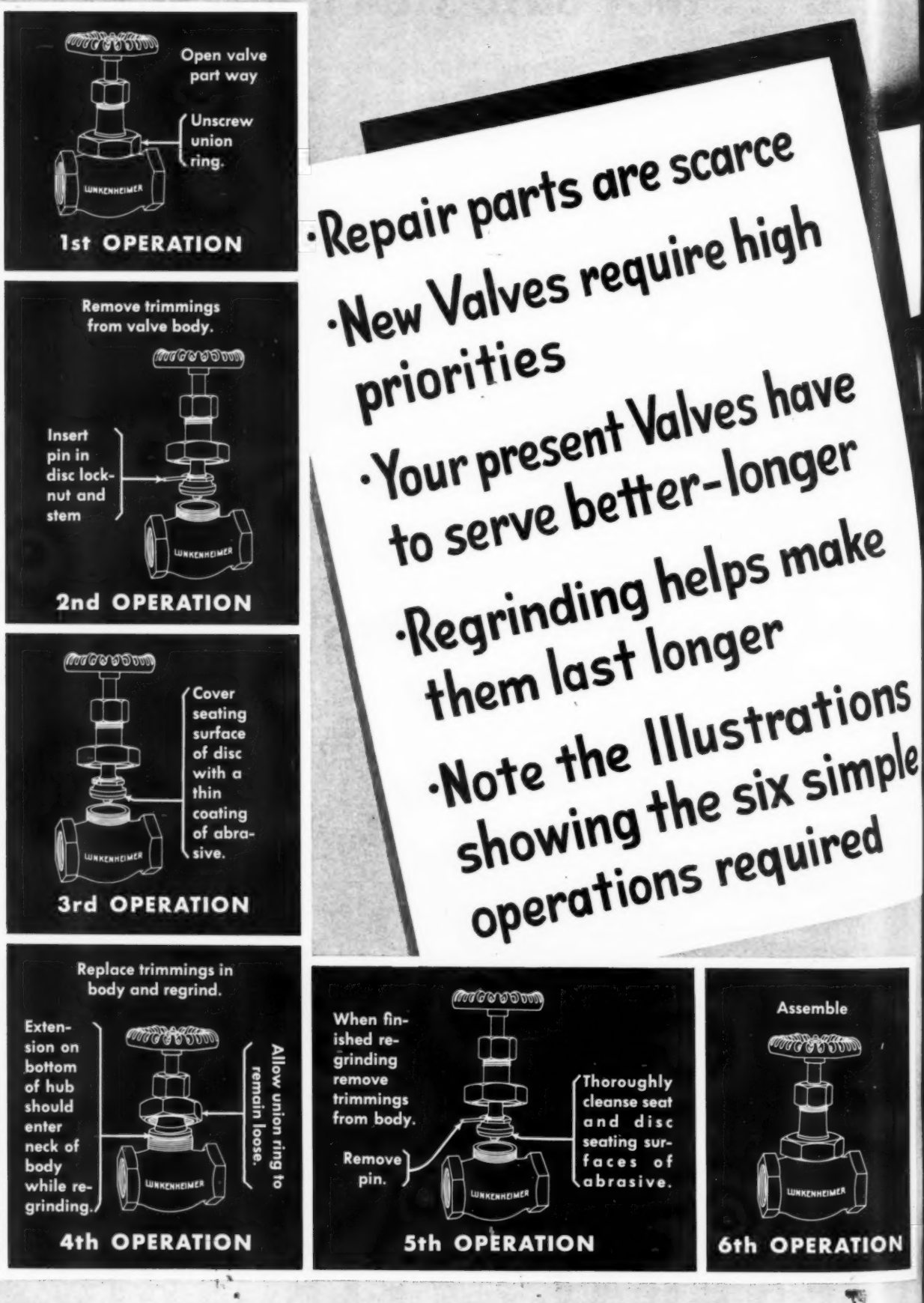
Name .....

Company .....

Address .....

City ..... *State* .....

GENERAL ELECTRIC


Open valve part way
Unscrew union ring.
LUNKENHEIMER
1st OPERATION
Remove trimmings from valve body.
Insert pin in disc lock-nut and stem
LUNKENHEIMER
2nd OPERATION
Cover seating surface of disc with a thin coating of abra-sive.
LUNKENHEIMER
3rd OPERATION
Replace trimmings in body and regrind.
Exten-sion on bottom of hub should enter neck of body while re-grinding.
Allow union ring to remain loose.
LUNKENHEIMER
4th OPERATION
When fin-ished re-grinding remove trimmings from body.
Remove pin.
Thoroughly cleanse seat and disc seating sur-faces of abrasive.
LUNKENHEIMER
5th OPERATION
Assemble
LUNKENHEIMER
6th OPERATION
·Repair parts are scarce
·New Valves require high priorities
·Your present Valves have to serve better-longer
·Regrinding helps make them last longer
·Note the Illustrations showing the six simple operations required

You Can't Afford Leaky Valves

They're expensive and they may result in costly slow-downs and sometimes even shut-downs — which can't be tolerated in these critical times.

With proper care . . . periodic inspection to locate even slight leaks . . . and immediate repair, your valves will serve you better and last longer.

Lunkenheimer Valves are easy to keep in good operating condition. Seats and discs can be readily reground and all parts are quickly accessible without taking the valves out of the line. Properly cared for, they give you a practically permanent installation.

The complete facilities of Lunkenheimer distributors are at your service. They'll go all out to help you get the things you need.

ESTABLISHED 1862

THE LUNKENHEIMER CO.

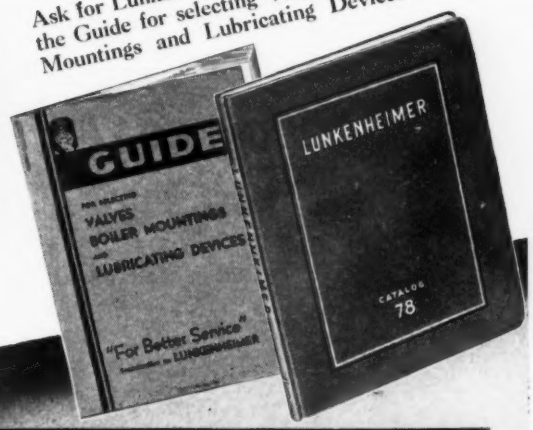
"QUALITY"

CINCINNATI, OHIO, U. S. A.

NEW YORK CHICAGO
BOSTON PHILADELPHIA

EXPORT DEPT. 318-322 HUDSON ST., NEW YORK

Ask for Lunkenheimer Catalog 78 and the Guide for selecting Valves, Boiler Mountings and Lubricating Devices.



BRONZE, IRON, STEEL AND CORROSION RESISTANT ALLOY VALVES, 125 TO 2500 LB. S.P.; BOILER MOUNTINGS, LUBRICATING DEVICES, AIRCRAFT FITTINGS

No. 3-79-42

SIEGE GUNS...

HAULING 155-mm. siege guns like these into position is a typical wartime use of Diesel power.

Whether furnishing power for hauling heavy guns, or generating light and power for industry or home use, Diesels everywhere are operating more economically . . . lubricated with Texaco.

Texaco Ursa Oils keep engines *clean*. Their use assures long life of bearings and liners, free rings, compression-tight piston seal, full power, and *fuel economy*.

So effective have Texaco lubricants proved that they are definitely preferred in many important fields, a few of which are listed in the panel.

A Texaco Lubrication Engineer will gladly cooperate in the selection of the most suitable lubricants for your equipment. Just phone the nearest of more than 2300 Texaco distributing points in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York, N. Y.

THEY PREFER TEXACO

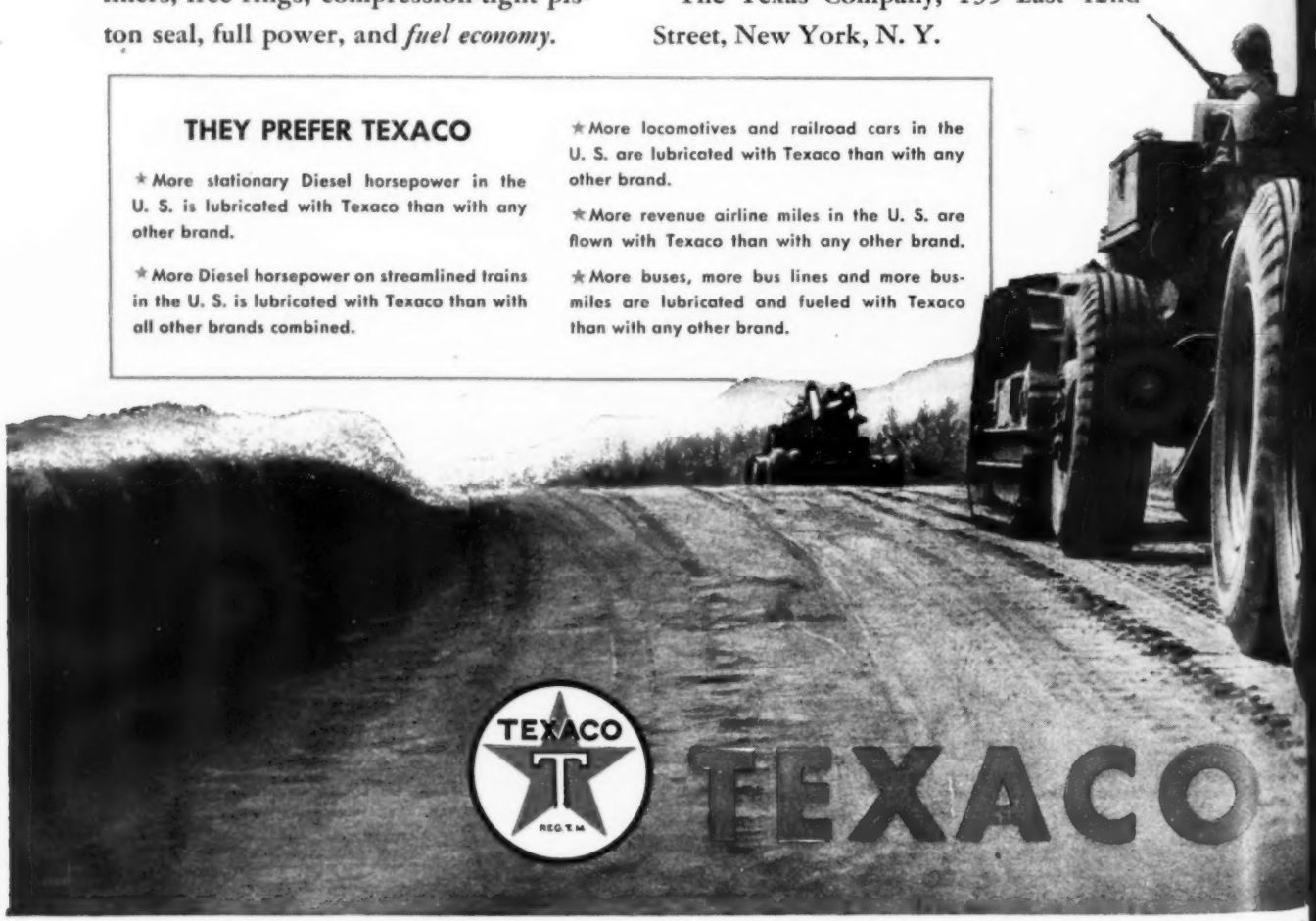
★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

★ More locomotives and railroad cars in the U. S. are lubricated with Texaco than with any other brand.

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★ More buses, more bus lines and more bus-miles are lubricated and fueled with Texaco than with any other brand.



TUNE IN THE TEXACO STAR THEATRE EVERY SUNDAY NIGHT—CBS

Dieselized!

HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

Sump Pump in Service for 25 Years Shows Superiority of Monel Rods

Installed in 1918, pump with Monel rods still gives perfect service... second pump, after failure of 3 sets of bronze rods in 10 years, now also equipped with Monel

Here's a striking demonstration of Monel's performance.

It's the record established by Monel pump rods in two pumps . . . used in the Public Library at 42nd Street, on Fifth Avenue, New York City.

Both pumps are used to clean out a sump where the drainage is exceedingly gritty and dirty. Waters used for quenching ashes (the water trickling down into the sump from the ash piles), polluted waters from ground seepage, and corrosive waters draining from the coal bins run into this sump, making a combination that is highly corroding and abrasive.

Working under these severe conditions, Monel pump rods have established a remarkable record of long, trouble-free service.

The oldest pump, installed in 1918, was equipped with Monel rods.

After 25 years, these original Monel rods are still at work, giving completely satisfactory performance. These rods have never been redressed; the only attention they receive is a repacking every couple of years with ordinary flax packing at the water end and Klinger asbestos at the steam end.

"The Monel Rods will last as long as the pump itself," is the judgment of Chief Engineer Earl I. Gates of the Library.

The second pump, installed in 1928, was equipped with bronze rods. Three sets of these bronze rods failed during the first ten years the pump was in service. When the fourth set was installed, Monel rods were used. They have now been at work for six years and are in perfect operating condition.

Veteran Monel installations such as these are now paying dividends in many ways. They conserve the time of hard-pressed maintenance and repair men. They lessen the number of expensive shutdowns. They save strategic metals by eliminating the necessity for replacements where failure of parts might otherwise have occurred.

Its combination of toughness, long life and resistance to both abrasives and corrosion makes Monel uniquely suited for uses where all of these properties are vital. For further information about Monel and other INCO Nickel Alloys, write: The International Nickel Company, Inc., 67 Wall St., New York 5, N. Y.

Monel rods on this pump at the N. Y. Public Library are still giving perfect service after 25 years.

★ ★ ★ ★ **INCO NICKEL ALLOYS** ★ ★ ★ ★

MONEL • "K" MONEL • "S" NONEL • "R" MONEL • "KR" MONEL • INCONEL • NICKEL • "Z" NICKEL

Sheet...Strip...Rod...Tubing...Wire...Castings

WHY USE STRING for a ROPE JOB

on Multi-V-Belts?

ONE big reason for the standout performance of Goodyear *Black* E-C Cord Multi-V-Belts —in any section—is the size of the load-carrying cords.

All Goodyear Multi-V-Belts are sinewed with the same large, husky, endless rope-cords used in the world-famous Goodyear COMPASS Cord flat transmission belt—known throughout industry as the longest-lived, truest-running, lowest-overall-cost flat belt ever built. This heavy rope cord permits adequate strength to be concentrated in the neutral section of the belt.

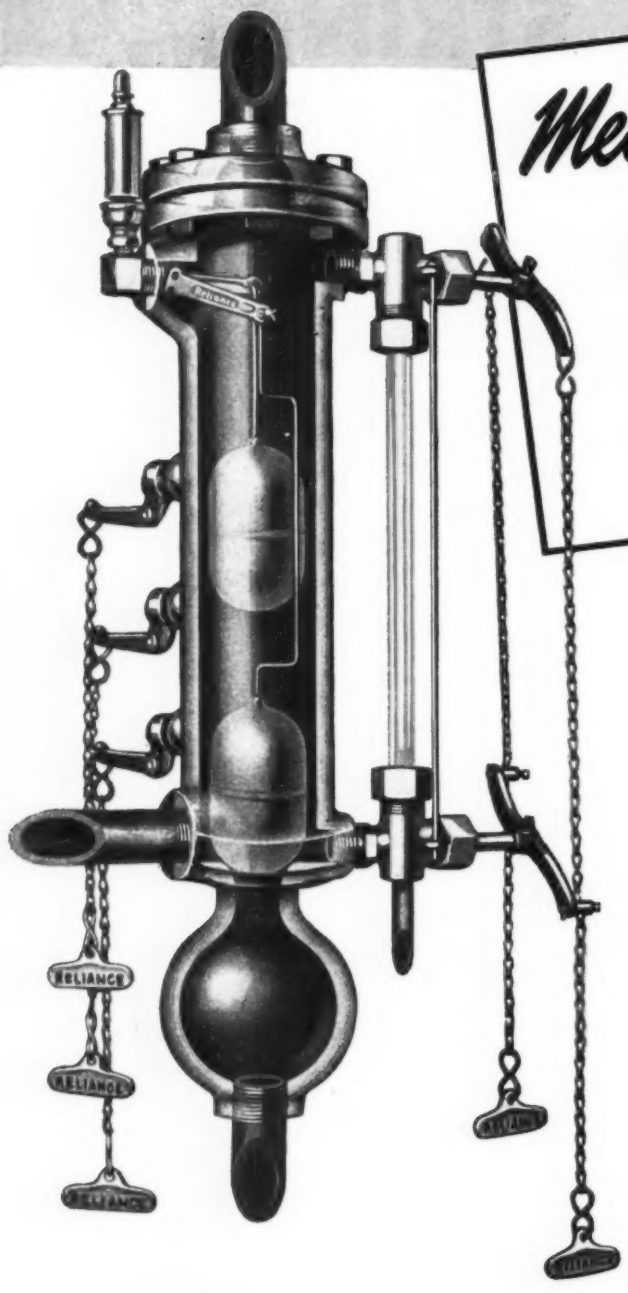
In comparison, most conventional V-belts are bodied with light, stringy cords. (Cut them open and see for yourself.) You will find they have so many layers of string cords that some are bound to fall in the compression section. These belts are vulnerable to ply separation. It is like sending a gang of small boys to do a man's work! On tough drives you need the big cords for long life.

Add the perfect matching — the tough wear-resistant black cover—the tight-gripping, accurately molded cross sections of Goodyear E-C Cord Belts—and you get performance that can't be beat.

In addition, for extra-tough, war-priority drives, Goodyear now builds the revolutionary steel cable V-belt—the world's heavy-duty champion. For correct application of V-belts, consult the G. T. M. — Goodyear Technical Man. Write Goodyear, Akron, Ohio or Los Angeles, California — or phone the nearest Goodyear Industrial Rubber Goods Distributor.

E-C Cord, COMPASS—T. M.'s The Goodyear Tire & Rubber Company

Why the Reliance Safety Water Column is



Mechanical Simplicity assures positive boiler protection under today's "Win-the-War" stresses

Nowadays you're thankful for all the dependable, low maintenance controls and devices you've had the foresight to install. Owners of Reliance Safety Water Columns know that their simplicity is their strength—their sensitive trouble-free mechanism a known factor that guards boiler water levels as faithfully as a military sentinel.

Action of the ALARM is direct and foolproof. There's nothing to adjust or get out of order in the operating mechanism, which is high in the column, safe from scale, sediment and corrosion. When water level falls below a safe normal, weight of the alarm float pulls open the whistle valve—the warning calls operators, helps prevent burned out tubes, cracked headers, bulged sheets and serious explosions.

When water rises above a predetermined point, high alarm float is buoyed up, opening whistle valve to warn against the chance of priming or slugs of water carried over to damage engine or turbine.

You can be sure of maximum service from Reliance Alarms if simple installation instructions have been followed. We recommend that you check care-

Since 1884

Reliance

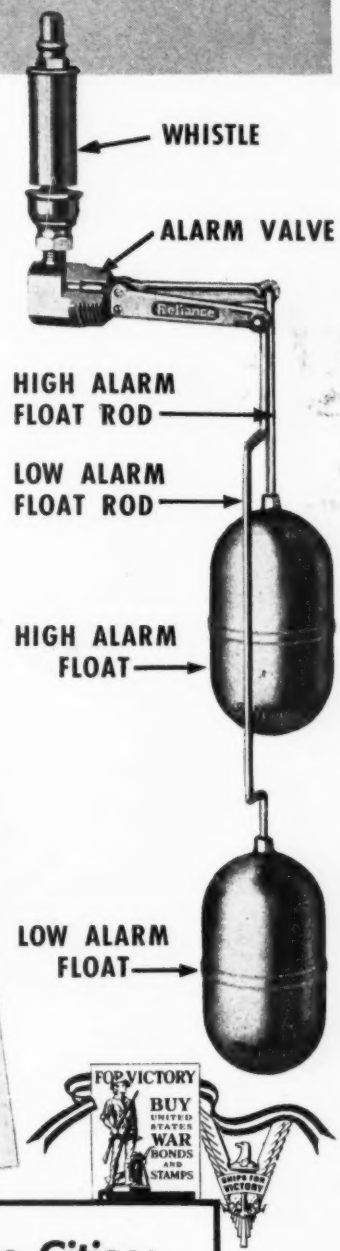
BOILER SAFETY DEVICES

is Vital to your busy War Production

fully the A. S. M. E. and local Code requirements and compare your hook-up with their rules. Be sure all connections run straight. Provide for cleaning by installing crosses with plugs at all right-angle turns as pipe and fittings often stop up with scale and sediment. Complete instructions for installing the column and replacing its parts are covered in Reliance Form Number 429.

Long wear, or unusual accidents while cleaning column and piping may necessitate some replacement of parts. As you probably know, you can order maintenance parts on an MRO priority. It will be helpful if you refer to *Reliance Replacement Parts Order Blank, Form 392-A*—or write for a copy—to give you the correct parts names. Always state the catalog number of your Reliance Column, which you find on the sediment chamber or on number plate.

The importance of insuring positive water level supervision through the Safety Water Column and adequate Gage Equipment is recognized by all competent engineers. . . . To keep up-to-date on construction facts write for latest Reliance Alarm Catalog 414.

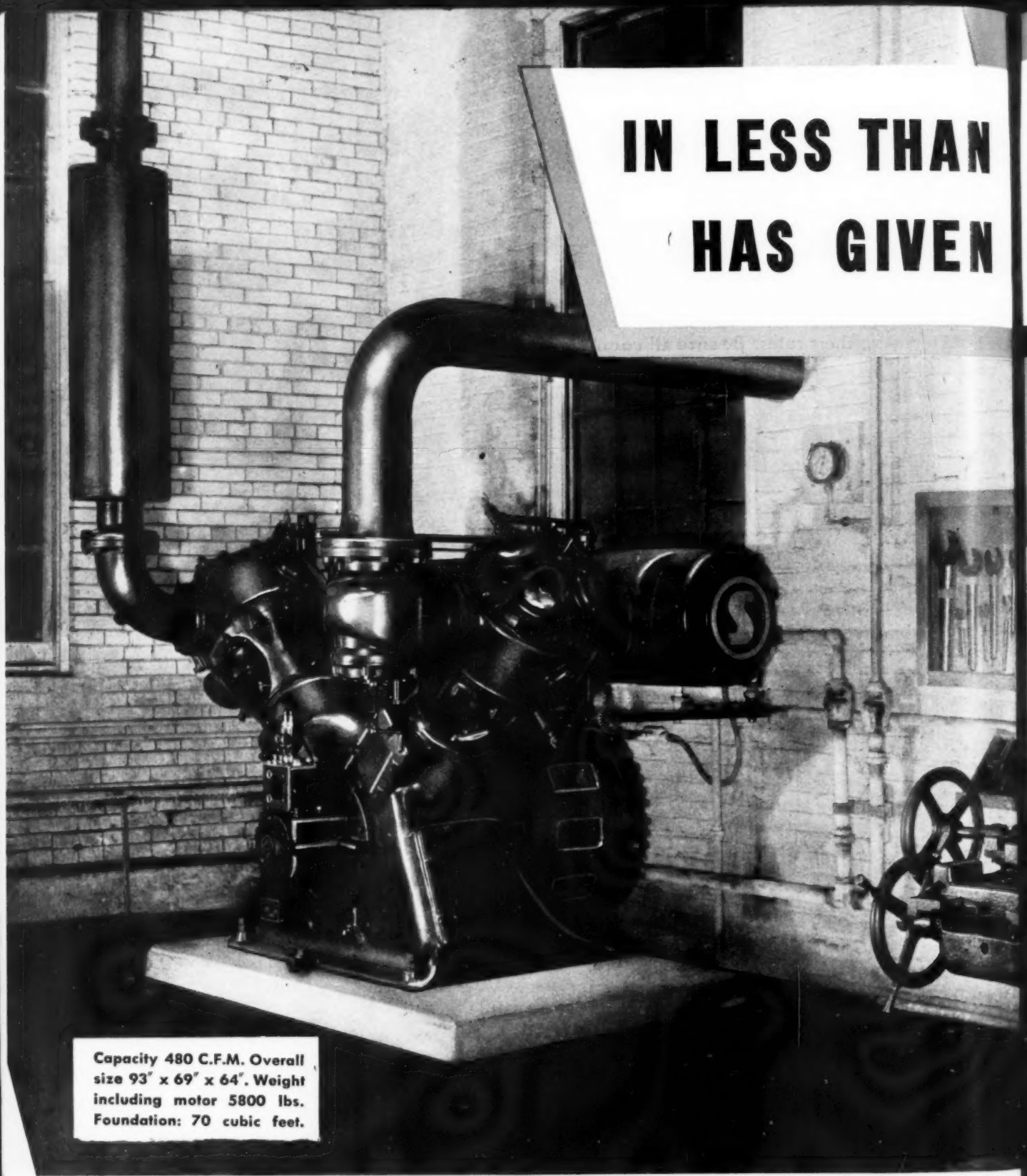


RELIANCE BOILER ALARMS
(Safety Water Columns)
FOR SAFER, SURER CONTROL OF BOILER WATER LEVELS
The Reliance Gauge Column Company
CATALOG 414
How to Install the Reliance Alarm Water Column
Reliance Alarm Replacement Parts Order Blank
THE RELIANCE GAUGE COLUMN CO.

Reliance Representatives Serve You from These Cities:

Atlanta, Georgia	Houston, Texas	Pittsburgh, Penna.
Birmingham, Alabama	Indianapolis, Indiana	Richmond, Virginia
Boston, Massachusetts	Los Angeles, California	Rochester, New York
Buffalo, New York	Milwaukee, Wisconsin	St. Louis, Missouri
Charlotte, North Carolina	Minneapolis, Minnesota	Salt Lake City, Utah
Chicago, Illinois	Montreal, Quebec, Canada	San Francisco, California
Cincinnati, Ohio	New Orleans, Louisiana	Seattle, Washington
Denver, Colorado	New York City	Tulsa, Oklahoma
Detroit, Michigan	Philadelphia, Penna.	Washington, D. C.

THE RELIANCE GAUGE COLUMN CO. • CLEVELAND, OHIO



Capacity 480 C.F.M. Overall size 93″ x 69″ x 64″. Weight including motor 5800 lbs. Foundation: 70 cubic feet.

Sullivan PACKAGE TYPE COMPRESSORS

From 378 to 3656 C.F.M. 2 and 4 cylinder types. Complete, compact, self-contained, long-lived, heavy-duty units for continuous service. Two-stage, double-acting. Much smaller than old-style compressors with same capacity, they offer great savings in installation time, space, materials and labor, and equal or greater operating economies. Sullivan Package Type Compressors arrive ready to be hooked up to power, water and air lines and go into 24-hour per day service. Particularly suited for synchronous motor drive; well adapted for steam turbine or diesel drive.

FEATURES OF ALL *Sullivan* P.T. COMPRESSORS

Most modern metallurgical developments, engineering design and precision manufacture used throughout. Lifetime service anti-friction main bearings, crossheads and crosshead liners. Non-adjustment crosshead bearings run in mirror-finish honed crosshead guides which last indefinitely. Exactly balanced low pressure and high pressure pistons. Removable cylinder liners honed to a satin finish. Complete force feed lubrication with all pump flow passing through filters. When equipped with efficient filters and a good grade of crankcase oil is used, compressor will run 3000 hours without attention.

6 YEARS' TIME THIS COMPRESSOR
20 YEARS OF NORMAL SERVICE

. . . 45,000 Hours of Non-Stop Operation with Near-Zero Maintenance

The picture shown here is of one of the first Sullivan Package Type Compressors to be placed in operation. It went into service in October, 1937, in the roundhouse of a well-known mid-west railroad. It started running day and night, 7 days a week and except for oil changes it has been running day and night ever since. During these 67 months of continuous operation, the equivalent of 20 years of normal 8-hour-per-day service, total service wear repair parts costs were $84.45 . . . less than 1/100th of a cent per thousand cubic feet of compressed air delivered. Total "down time" was less than 5 hours.

This record was established with only normal maintenance attention and without *any bearing surface adjustments whatsoever* . . . in line with the original factory-built-in non-adjustment precision design incorporated in all Sullivan Package Type Compressors. For Sullivan has brought to heavy duty industrial compressor manufacture the same momentous progress in metallurgy, in engine design and in modern precision manufacturing methods that have made American achievements in the associated automotive, diesel and aeronautical fields the wonder of the entire world. These compressors have revolutionized all existing concepts of performance, dependability and stamina . . . in great aluminum plants, in steel mills, in mines, wood-working plants, navy yards, etc. If you want to know what Sullivan Package Type Compressors will do for you, write today to your nearest branch office.

SULLIVAN MACHINERY COMPANY, Michigan City, Ind. *In Canada:* Canadian Sullivan Machinery Co., Ltd., Dundas, Ont.

SULLIVAN

PACKAGE TYPE AIR COMPRESSORS

BOSTON . . . . 104 Brookline Ave.
CHICAGO . . 307 No. Michigan Ave.
NEW YORK . . . . . 30 Church St.
PITTSBURGH . . . 47 Terminal Way
ST. LOUIS . . . . . 2639 Locust St.
SAN FRANCISCO . . . . 145 10th St.
LOS ANGELES . . 2900 Santa Fe Ave.
DETROIT . . 2051 W. LaFayette Ave.

Birmingham
Butte
Dallas
Denver
Duluth
El Paso
Huntington
Knoxville
Scranton
Salt Lake City

MORE STEAM? Here is what you get with Hagan Automatic Combustion Control

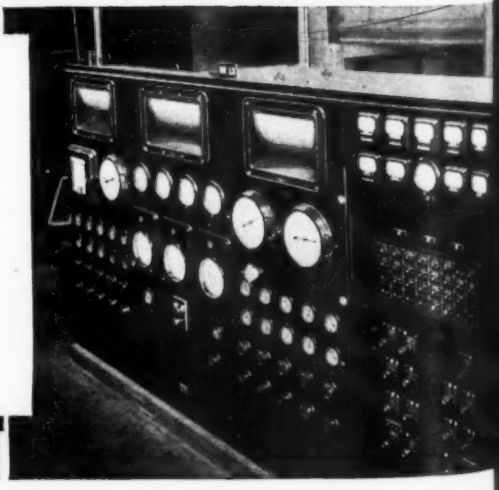
MAXIMUM QUANTITY of steam from any given plant, by introducing fuel and air in correct proportion for utmost efficiency.

MAXIMUM UTILIZATION value, uniform steam pressure and temperature, in accordance with demand.

MAXIMUM OUTPUT from boilers of differing capacities, automatically.

MAXIMUM STEAM for production, by reducing loss of steam in frequent soot-blowing.

MAXIMUM PROTECTION of auxiliary equipment, fans, stokers, etc., by maintenance of uniform operating conditions.



WHEN HEADQUARTERS KEEPS CALLING FOR MORE STEAM

IF you are doing everything you know how to step up the efficiency of your boilers and still fail to get a maximum output of steam, something is definitely lacking.

That "something" has proved in thousands of cases to be nothing more or less than *adequate* combustion control.

Because, regardless of other means employed to increase boiler capacity, Hagan Control, by adjusting all auxiliaries for maximum output, will insure the maximum of steam from every pound of fuel.

This is due to design superiority—rigid adherence to the sound principles pioneered by Hagan. If Hagan owes its wide acceptance by the power leaders of industry to any one thing, it is to the performance standards which are like law itself to Hagan engineers.

Every Hagan owner places complete reliance on the "mechanical brain" of the Hagan Control System. He knows it is never off the job—that it will do the work for which it was made with matchless, instantaneous precision.

Maybe you never have seen a plant operate under control like that. Maybe you didn't think it possible you could have such freedom from operating worries, such assurance of maximum results.

Then you should talk with a Hagan Combustion Specialist because he has the answers.

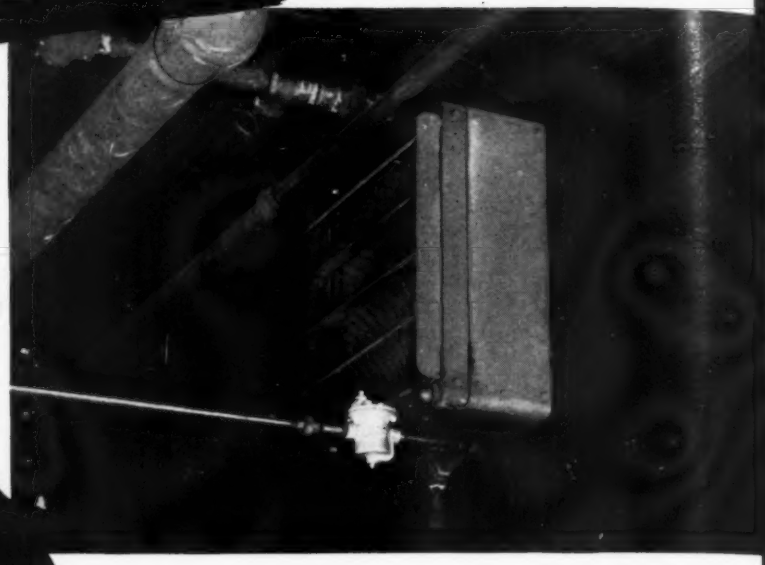
There is still time, fortunately. It is not too late to join the ranks of wartime producers who "when headquarters call for *more* steam" know they'll be able to produce it. Write, phone or wire for complete information about Hagan Control.

HAGAN CORPORATION · HAGAN BUILDING · PITTSBURGH, PA.

HAGAN *Automatic* COMBUSTION CONTROL

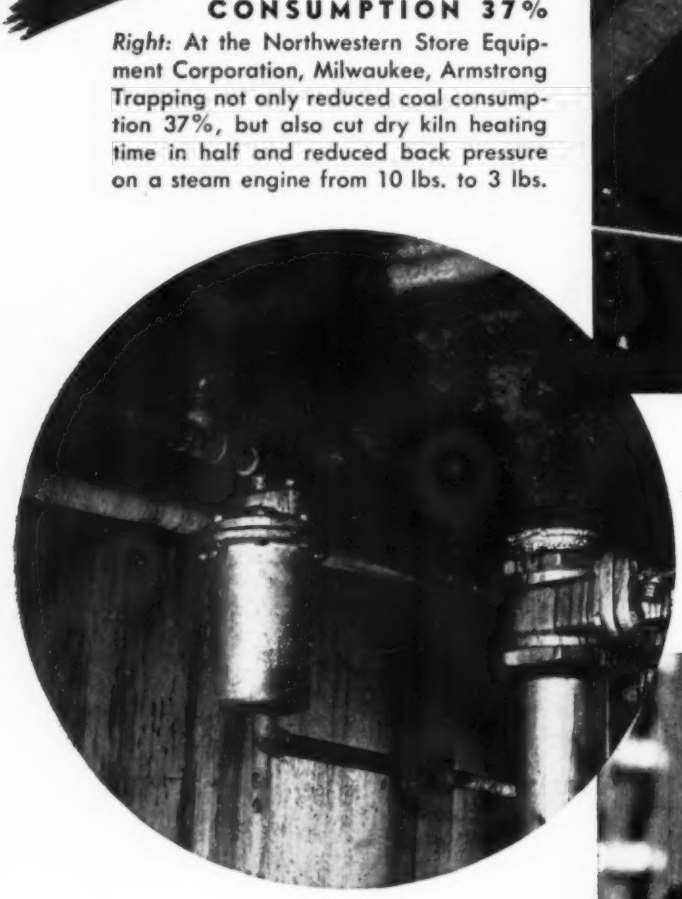
The pioneer . . . and still the leader

STEAM is where



REDUCES COAL CONSUMPTION 37%

Right: At the Northwestern Store Equipment Corporation, Milwaukee, Armstrong Trapping not only reduced coal consumption 37%, but also cut dry kiln heating time in half and reduced back pressure on a steam engine from 10 lbs. to 3 lbs.



USES 50% LESS FUEL OIL

Circle: Midland Chemical Laboratories, Dubuque, Iowa, report that an installation of Armstrong Trapping reduced their fuel oil consumption over 50%. They further state that instead of a new 125 H.P. boiler which they had on order, they were able after trapping, to meet their needs with an 80 H.P. boiler.

ELIMINATE NEED FOR NEW BOILER

Right: Armstrong Trapping on drier coils, jacketed kettles and other equipment at British Columbia Packers, Ltd., is credited with eliminating the need for a new boiler through more efficient utilization of and savings of steam.

ARMSTRONG · TRADE MARK · "INVERTED BUCKET" STEAM TRAP

Armstrong

...you save it

IN face of fuel crises and inadequate boiler capacities, one answer to the problem of how to get more steam for productive use is to make sure that no steam is wasted through non-productive radiation losses or leaky and inefficient traps.

Steam today is where you save it and many plants have learned that the steam-savings possible with Armstrong Trapping are great enough to supply all needed additional steam, save fuel, increase production and eliminate the need for new boilers.

Here's why Armstrong Traps are able to produce such outstanding results:

NO STEAM LOSS—*No steam can escape through the Armstrong discharge orifice, even where there is no condensate load. The valve stays closed* tight *until condensate accumulates and then* only *condensate and air are discharged.*

MINIMUM HEAT LOSS—*No cooling legs are required ahead of an Armstrong Trap. The only heat loss is the small amount occuring due to radiation from the trap itself.*

AUTOMATIC AIR ELIMINATION—*Air is automatically discharged ahead of the condensate in an Armstrong Trap. This means greater utilization of the heat in the steam, higher temperatures, faster heating and higher production.*

LONG LIFE—*There are only two moving parts in the Armstrong Trap—the bucket and the free-floating valve lever assembly. The valve opens wide and closes tight, eliminating wire drawing. There is no sticking or clogging. These features are your guarantees of continued steam saving ability over long periods.*

Study the steam loss table at the right—multiply it by the possible sources of leakage through faulty condensate drainage in your plant. Read the typical results other users are securing with Armstrong Trapping. Then call an Armstrong Representative. Write today.

ARMSTRONG MACHINE WORKS
812 Maple Street • Three Rivers, Mich.

Table showing cost of various sized steam leaks at 100 pound pressure (assuming steam costs 50 cents per 1000 lbs.)

Size of Orifice	Lb. Steam Wasted Per Month	Total Cost Per Month	Total Cost Per Year
½"	835,000	$417.50	$5,010.00
⅜"	470,000	235.00	2,820.00
¼"	210,000	105.00	1,260.00
⅛"	52,500	26.25	315.00
1/16"	13,200	6.60	79.20
1/32"	3,400	1.70	20.40

(For steam at 50 pounds pressure, the waste is about 75% of the above figures; at 20 pounds, it is about 50%; and at 5 pounds, the loss is about 25%.)

Send for these Steam Trap Books!

How to select the right trap for the job is easy with the Armstrong Steam Trap Book. And how to get the most out of your traps is well explained in the new Service Guide. Ask for copies.

STEAM TRAPS

Mile-a-Minute Speed

pounded life out of belts in 2 months—

but not Any More!

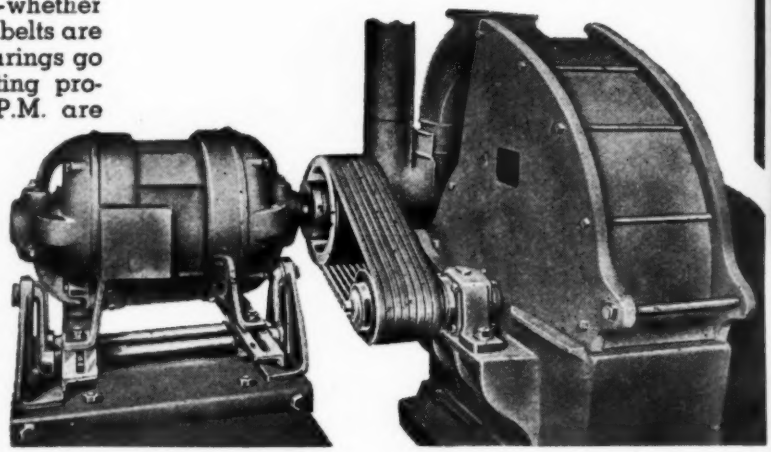
Mile-a-minute belt speed, plus a heavy starting load—requiring extra high belt tension—was causing a flour mill operator plenty of trouble. Belts wore out in two months on his hammermill drive. Cost of replacements were excessive. Shutdowns were a headache. Something had to be done.

An *American Econ-o-matic Drive* solved the problem. Belts now take starting load easily and give normal service life. In less than a year, the drive paid for itself by savings through lengthened belt life and reduced maintenance attention.

Improper belt tension causes many costly production and maintenance problems—whether starting loads are heavy or light. When belts are too tight they wear out rapidly and bearings go bad—forcing shutdowns and interrupting production. When belts are too loose, R.P.M. are lost and machine output is reduced.

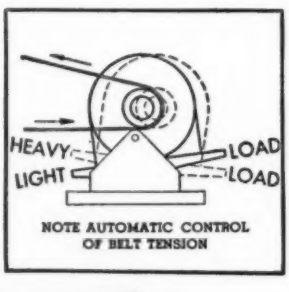
You overcome these problems when you change to American Econ-o-matic Drives. You increase machine output, double belt life, lengthen bearing life and reduce maintenance attention.

The Econ-o-matic Drive is an American Short-Center Drive—either Flat-belt or V-belt—with an Econ-o-matic Motor Base that gives you *automatic* belt tension control. No more worry about belts too tight or too loose. No lost R.P.M. No belt slip. No unnecessary "time outs" for frequent manual adjustments.



Get This New Econ-o-matic Handbook

Here's a handbook of helpful information that shows you how to solve drive maintenance problems—how American Econ-o-matic Drives can help you increase machine output. It provides you with complete drive data. It shows how to select the right drive for your purpose. Send for your copy. Write now.

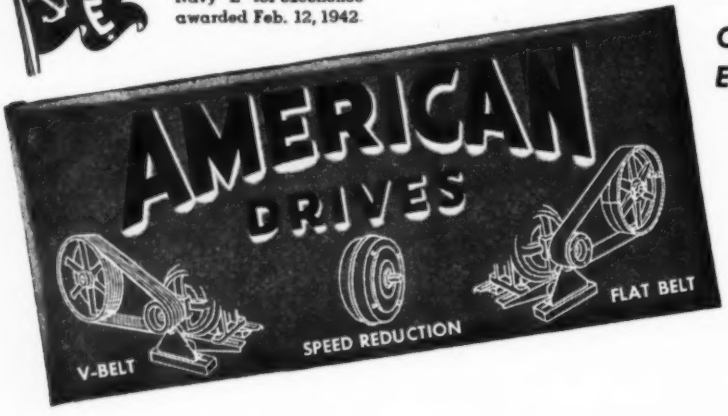


NOTE AUTOMATIC CONTROL OF BELT TENSION

AMERICAN Econ-o-matic DRIVE

. . . the load governs belt tension. Here is the heart of the Econ-o-matic Drive . . . the American Econ-o-matic Motor Base. It *automatically* and *instantly* matches belt tension to each variation in the load on the motor. When load is heavy, belt is automatically tightened. When load is light, belt is automatically loosened. There is never more tension on the belt than the load requires. No slide rails or idlers to adjust. It's automatic!

Navy "E" for excellence awarded Feb. 12, 1942



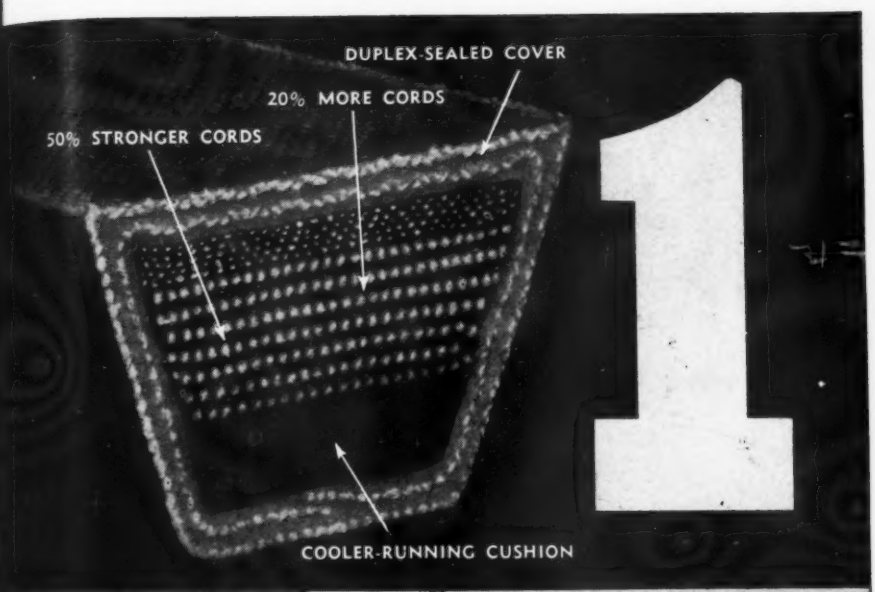
Check these advantages of the AMERICAN Econ-o-matic DRIVE (Short-center Flat- or V-belt Type)

- ★ *Longer life for belts and bearings*
- ★ *No belt slip—no lost R.P.M.*
- ★ *Maintenance man-hours greatly reduced*
- ★ *Smooth, cushioned starting*
- ★ *Increased machine output*
- ★ *Substantial power savings*

The American Pulley Company

4206 WISSAHICKON AVE., PHILADELPHIA, PA.

PUT THE Brakes on V-Belt Wear (DO IT TWO WAYS)



1

BUY THE BEST BELTS. .

You'll find design-against-wear at its finest in Texrope Super-7 V-Belts! 20% more pulling cords — each *50% stronger*, thanks to the New Flexon Process — combat stretching, give Super-7's extra power and durability. Cords are eased around sheaves on a shock-absorbing cushion of special cool-running rubber that combats flexing heat, enemy of V-belts. Tough, new Duplex-Sealed cover protects inner belt structure. When you do need new belts, *invest in the best* — Texrope Super-7!

[PRINCIPLE OF THE V-BELT DRIVE]

Like Bending an Arm

...Bending a V-Belt

Bulges its Muscle!

2

USE THE BEST CARE. .

Whatever brand of V-belts you are now using, you can make them last *longer* by following the tips in Allis-Chalmers' free handbook: Plain Facts on Wartime Care of Rubber V-Belts." Typical contents: how V-belt anatomy affects maintenance . . . good rule-of-thumb for tension . . . seven dead V-belts and what killed them. Packed with practical data, fully illustrated, the new handbook is specially suited for training new men. Tear off the coupon below and send for this valuable new handbook today!

ALLIS-CHALMERS

TEXROPE SUPER-7 V-BELTS

WE WORK FOR VICTORY — WE PLAN FOR PEACE

Trade mark registered U. S. Patent Office. Texrope Super-7 V-Belts are the result of the cooperative research and design genius of two great companies—Allis-Chalmers and B. F. Goodrich—and are sold exclusively by Allis-Chalmers. Available in all sizes.

ALLIS-CHALMERS MFG. CO.
Milwaukee, Wisconsin

Gentlemen:

Yes, I would like to receive free of charge a copy of your "Plain Facts on Wartime Care of V-Belts".

(Name)

(Title)

(Company)

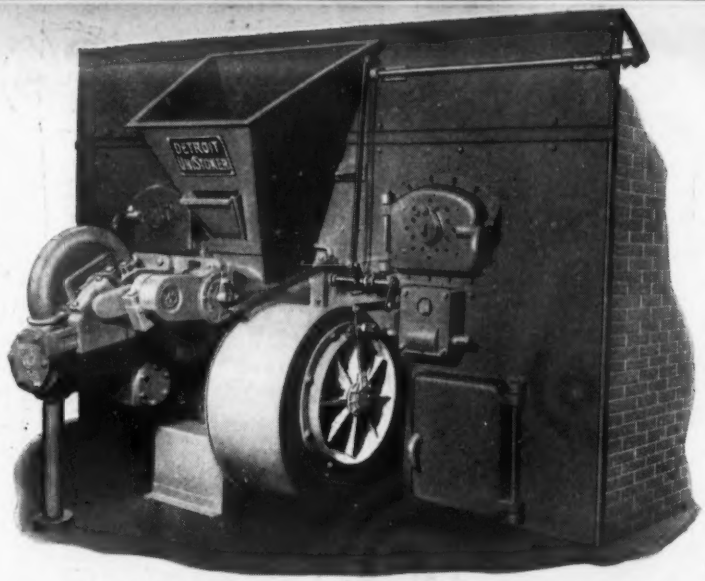
(Street Address)

(City and State) A-1605-1

12

Detroit Stokers In A Row

Serving A

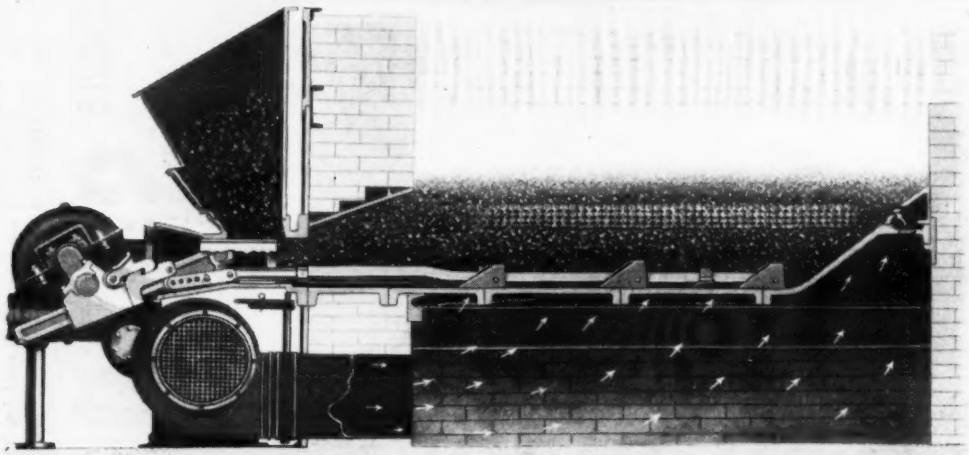


Detroit UniStoker is of a compact design, motor or steam turbine driven, automatically controlled.

Serving A Large Defense Plant

Extreme flexibility and stability of Detroit UniStokers provided the exact characteristics needed in this Large Defense Plant.

Five contracts for 12 Stokers with 250 horsepower boilers. Each UniStoker has an Adjustable Coal Feed that provides accurate regulation of fuel feed and air supply for all capacities.



Detroit UniStoker has large capacity. Adjustable Feed insures proper distribution, regardless of the load.

WRITE FOR BULLETIN 630

DETROIT STOKER COMPANY

Fifth Floor, General Motors Building, Detroit, Michigan

Works at Monroe, Mich. • District Offices in Principal Cities

Built in Canada at London, Ontario

THE BABY'S NAME IS

...FUTURE!

On every battlefront, drops of diesel oil are supplying power for artillery phones, ship radios, submarine and aircraft repairs. And on these same fronts, Americans are supplying the mind and muscle and courage that battle needs . . . But have you ever realized that in each man's arm there rests a baby? Its name is Future. His future . . . and ours. It's there, content and waiting, day and night.

Each fighting man thinks of that Future differently. To one, it is the new little son he left behind. To another, the home he's going to have . . .

To us, it's a lusty, work-hungry infant that will be ready, with Victory, to work hard for us and our returned fighting men. *Diesel power* . . . for cheaper lighting . . . faster transportation . . . better portable power for us and all the neighbor nations of the world.

That's the baby *our* employee holds as he works, at the machine tool, the drawing board, the assembly line and shipping room. Rogers Diesel and Aircraft Corporation, 1120 Leggett Avenue, New York, N.Y. *Divisions:* Hill Diesel Engine Company, The Edwards Company, Edwards Aircraft Products, Inc., Ideal Power Lawn Mower Co.

ROGERS DIESEL AND AIRCRAFT CORPORATION

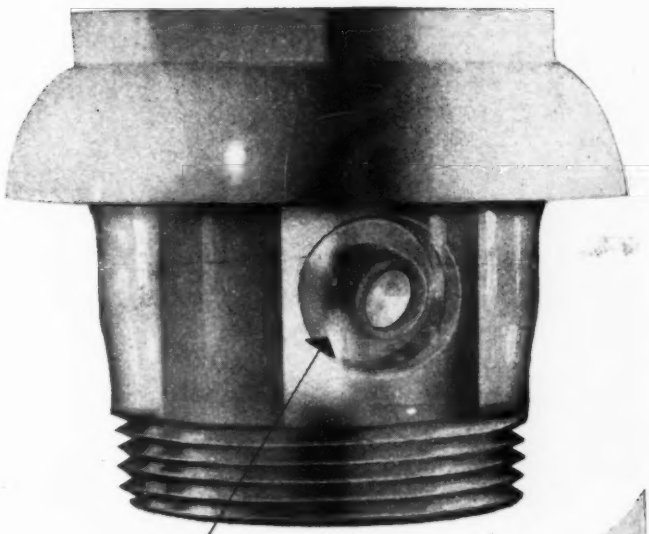
Diesel Engines, 5 to 2000 h.p. » Gasoline Engines » Generator Sets » Generators » Power Units » Switchboards
Pumping Units » Hydraulic Aircraft Equipment » Recoil Mechanisms » Power Mowers » Power Brushes
Snow Removal Equipment » Streamlined deluxe Railway Motor Trains » Diesel Locomotives

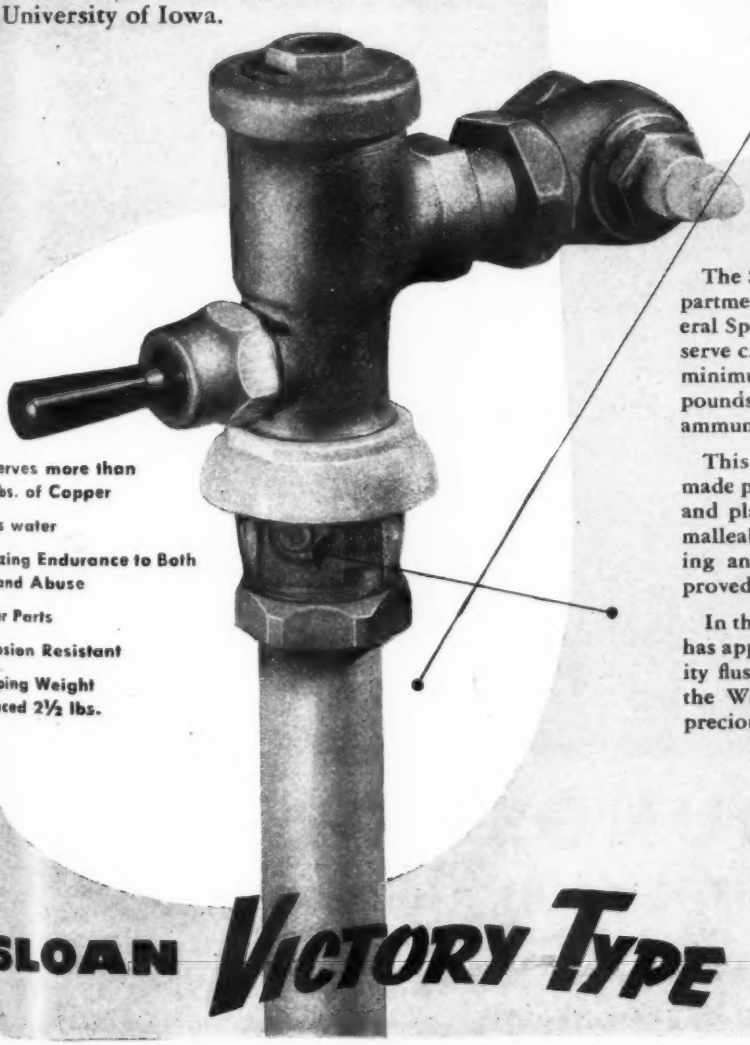
R D A

TRADE MARK REG.

NOW YOU CAN SEE HEALTH PROTECTION

Because vacuum breakers protect public health by preventing back syphonage, it is vitally important that they function perfectly at all times. In the Sloan V-100-A All Plastic Vacuum Breaker, you can now look through the transparent housing and actually *see* the butterfly valve in operation. This unique advantage gives you the surest means of checking on your vacuum breaker to see that it is actually protecting your potable water supply. This vacuum breaker, made entirely of highest quality plastics, is the same in functional design as the original V-100-A, which was the first vacuum breaker to be accepted by the National Plumbing Laboratory at the University of Iowa.





Conserves more than 5½ lbs. of Copper

Saves water

Amazing Endurance to Both Use and Abuse

Fewer Parts

Corrosion Resistant

Shipping Weight Reduced 2½ lbs.

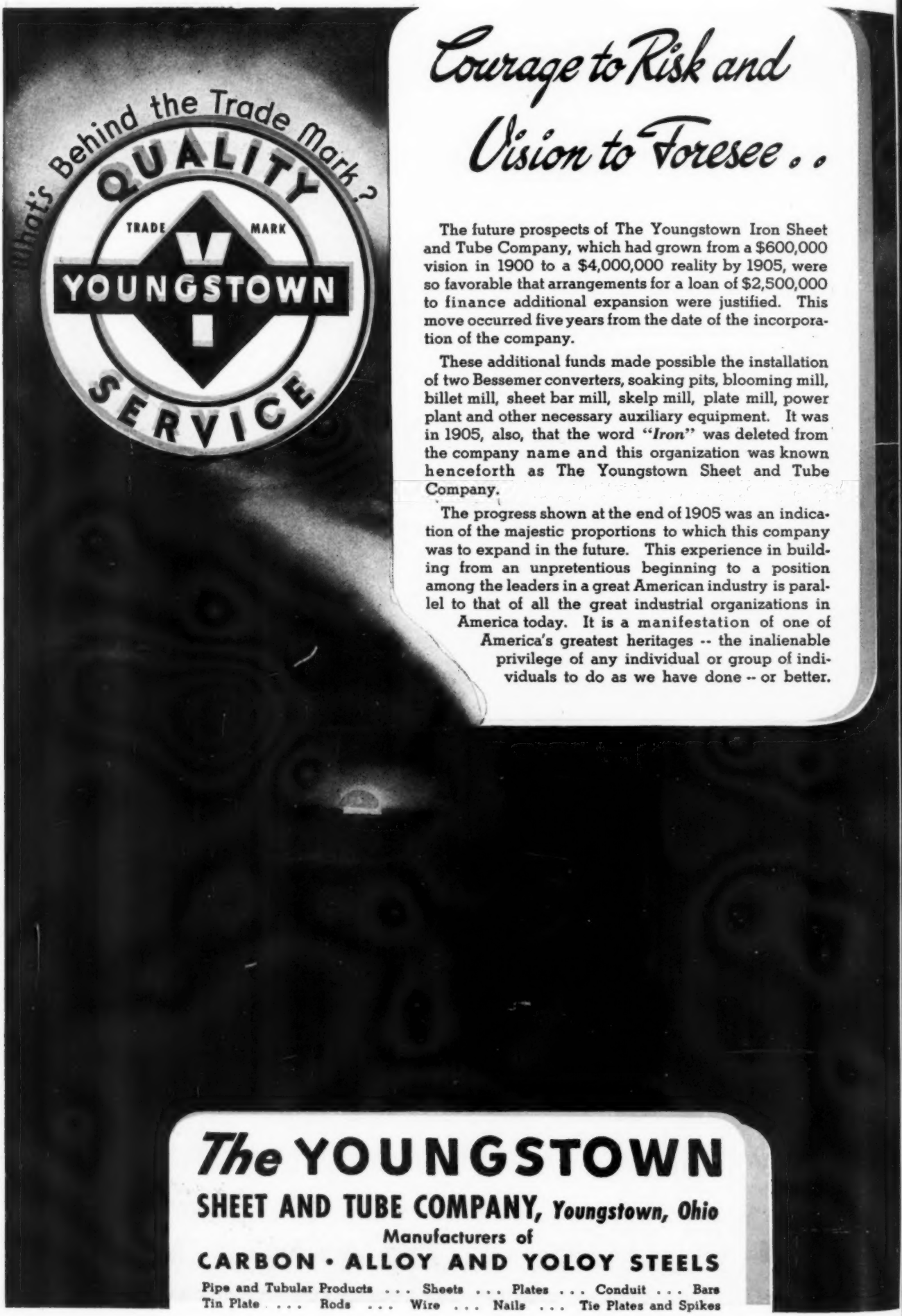
The Sloan VICTORY Valve conforms to War Department Specifications PE-623 and Emergency Federal Specifications E-WW-P-541a. Designed to conserve critical material, the VICTORY Valve uses the minimum amount of copper—in fact, more than 5½ pounds of copper per valve is now released for arms, ammunitions and other direct War uses.

This tremendous saving in critical material was made possible only through the use of malleable iron and plastics for component parts of the valve. The malleable iron parts have a baked-on protective coating and the whole valve, after rigorous tests, has proved itself far beyond expectations.

In the VICTORY Valve, the Sloan Valve Company has applied its every resource to produce a high quality flush valve which, in patriotic cooperation with the War program, uses the irreducible amount of precious copper.

SLOAN VALVE COMPANY
4300 West Lake Street
CHICAGO

SLOAN VICTORY TYPE FLUSH VALVES



Courage to Risk and Vision to Foresee . .

The future prospects of The Youngstown Iron Sheet and Tube Company, which had grown from a $600,000 vision in 1900 to a $4,000,000 reality by 1905, were so favorable that arrangements for a loan of $2,500,000 to finance additional expansion were justified. This move occurred five years from the date of the incorporation of the company.

These additional funds made possible the installation of two Bessemer converters, soaking pits, blooming mill, billet mill, sheet bar mill, skelp mill, plate mill, power plant and other necessary auxiliary equipment. It was in 1905, also, that the word "*Iron*" was deleted from the company name and this organization was known henceforth as The Youngstown Sheet and Tube Company.

The progress shown at the end of 1905 was an indication of the majestic proportions to which this company was to expand in the future. This experience in building from an unpretentious beginning to a position among the leaders in a great American industry is parallel to that of all the great industrial organizations in America today. It is a manifestation of one of America's greatest heritages -- the inalienable privilege of any individual or group of individuals to do as we have done -- or better.

The YOUNGSTOWN
SHEET AND TUBE COMPANY, *Youngstown, Ohio*

Manufacturers of

CARBON • ALLOY AND YOLOY STEELS

Pipe and Tubular Products . . . Sheets . . . Plates . . . Conduit . . . Bars
Tin Plate . . . Rods . . . Wire . . . Nails . . . Tie Plates and Spikes

"if you'll send us the shells!"

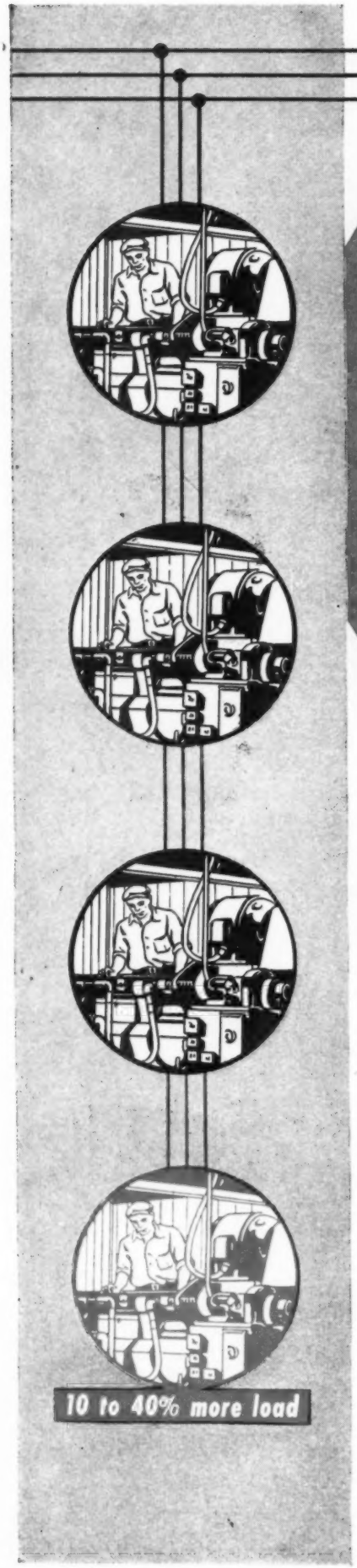
Our boys will bring down the enemy planes with their ack-ack fire, if we will give them the guns and the shells. So, let's all stay on the job *every* day to keep the equipment, ammunition and supplies rolling off the production line. And let's lend *every* dollar we can spare for War Bonds. We can win—we *will* win!

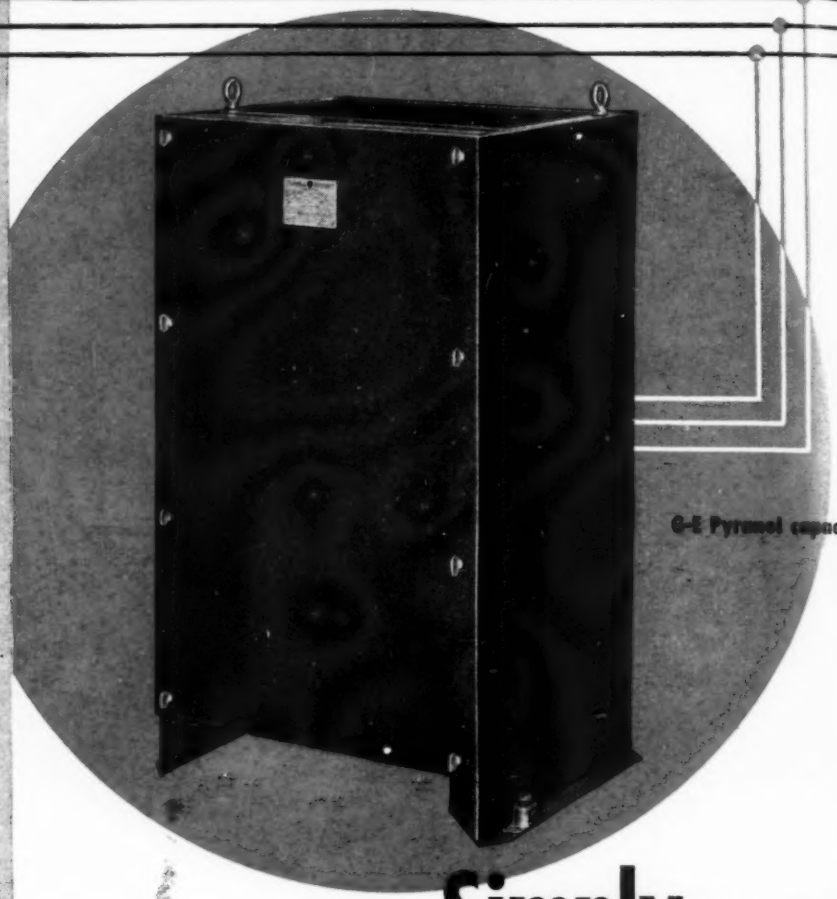
Garlock

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK

Manufacturers of GARLOCK Packings, Gaskets and KLOZURE Oil Seals

In Canada: The Garlock Packing Company of Canada Limited, Montreal, Que.





Simply by Adding *Pyranol* Capacitors*

You Can Make a Circuit Carry 10 to 40% More Load

CAPACITORS can help, if your plant's power system is fully loaded—or overloaded—and is operating at low power factor. How? The effect of a capacitor is to supply reactive kva that otherwise has to travel through your transformers and feeders. The circuit is thus enabled to carry more ***working*** current—as much as 40 per cent more in some cases.

Improvement of power factor by the addition of Pyranol capacitors will also: (1) Reduce load and heating of transformers and feeders, (2) Improve voltage conditions on the circuit, (3) Reduce energy losses.

You get results quickly when you install capacitors—a matter of weeks instead of the months necessary to get the same results with other methods. Standard ratings to meet practically all plant conditions are available. Installation is merely a matter of placing the capacitor in position and making connections.

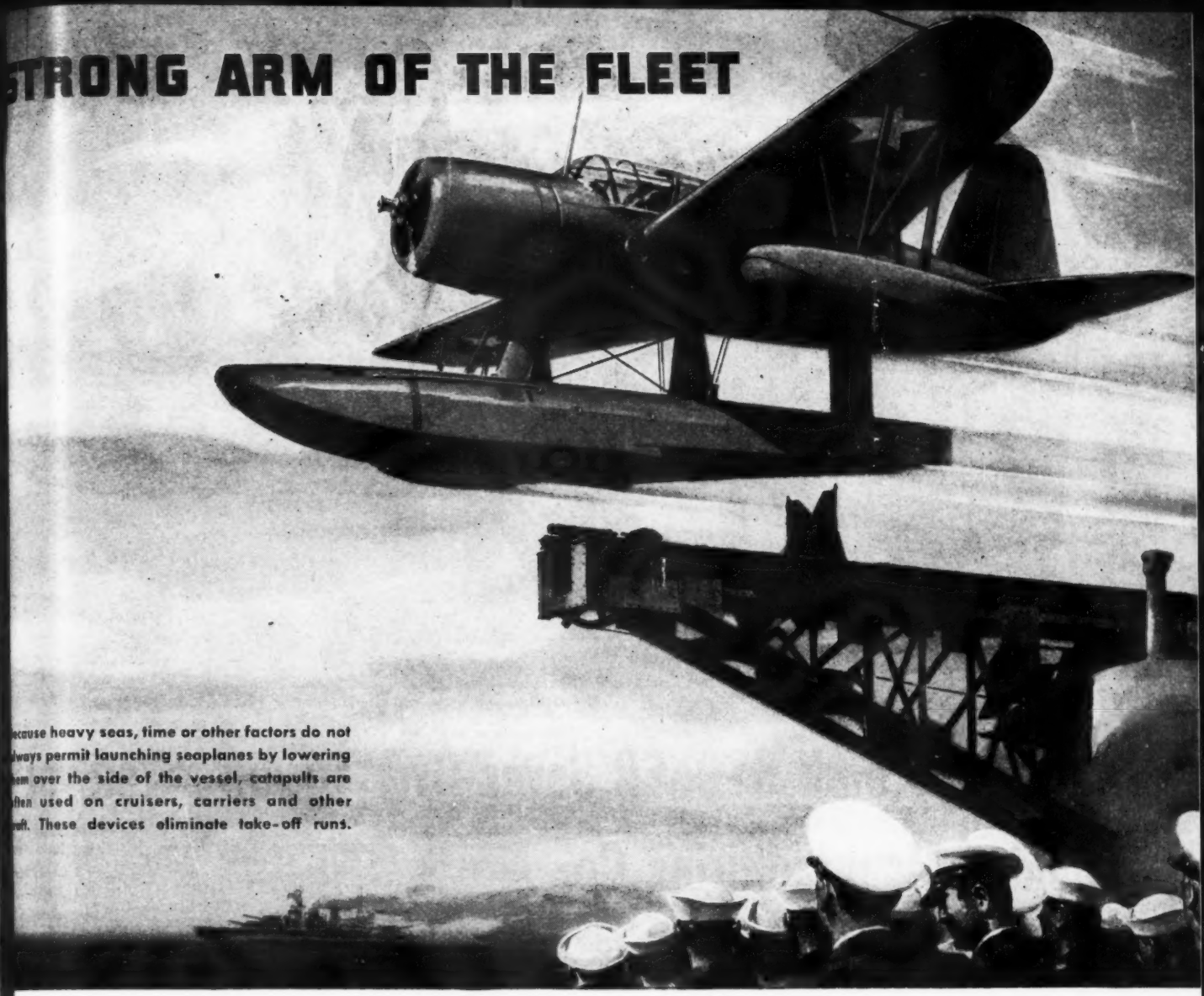
Ask your G-E representative today to estimate the possible increase in your circuit capacity, or write for Bulletin GEA-77. *General Electric, Schenectady, N. Y.*

*General Electric's trade name for a synthetic liquid dielectric that will not burn.

GENERAL ELECTRIC

407-55-5700

STRONG ARM OF THE FLEET



Because heavy seas, time or other factors do not always permit launching seaplanes by lowering them over the side of the vessel, catapults are often used on cruisers, carriers and other craft. These devices eliminate take-off runs.

TO THROW an airplane into the air takes a mighty strong arm. Launching these eyes of the fleet from a cruiser deck is the job of the catapult.

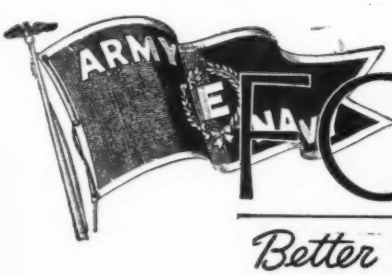
Gears on the catapult must be rugged to stand the punishing shock that comes when the speed of the airplane weighing more than two tons is increased from 0 to 70 miles per hour in a distance of 60 feet!

The gears in the engines powering these planes must be tough, too. For though light in weight, their job is to transmit the power of 2000 horses to whirling propeller blades.

Making these gears—the rugged ones for the launching devices and the marvels of high precision for the airplane engines—is Foote Bros.' job, and Foote Bros. are proud of the service that the gears they make are rendering—proud of the manufacturing know-hows, the advancements in techniques that have been developed to produce these gears in the tremendous quantities needed for an America at war.

But more important to American Industry is what these manufacturing know-hows will mean to peacetime production. For experience gained today in producing gears that are tougher—gears that possess a higher degree of precision—gears that demand the latest manufacturing technique will assure more economical power transmission—more efficient machines for American Industry when the war is won.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5225 South Western Boulevard • Chicago, Illinois

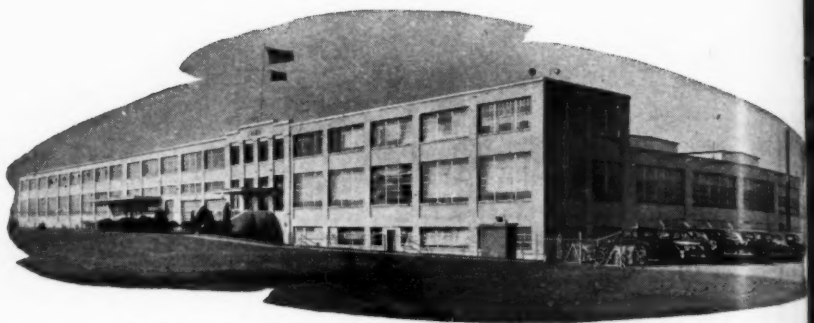


FOOTE BROS.

Better Power Transmission Through Better Gears

Boiler Capacity Up . . . Fuel Cost Down

WHIPPLE JACOBS, *President*
Belden Manufacturing Company



Exterior view of the Belden Manufacturing Company, Richmond, Indiana, well known makers of insulated copper wire, cable and cordage.

IRON FIREMAN STOKER Saves Over $3000 a Year at Belden Manufacturing Co.

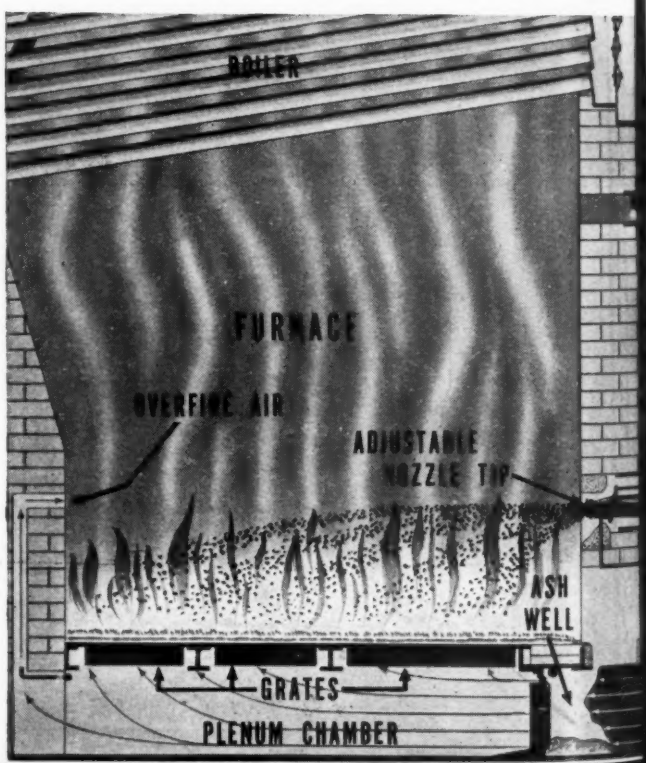
★ "In addition to providing a required increase in the capacity of our old boilers, we have reduced operating costs by $3,293 annually," reports D. D. McQuiston of the Engineering Department of Belden Manufacturing Company.

The Iron Fireman Pneumatic Spreader stoker model as used by Belden permits the use of local and lower cost coal, a vital advantage now when the transportation bottleneck presents serious difficulties. This greater efficiency and lower fuel costs are typical of thousands of war production plants that have changed to automatic coal firing.

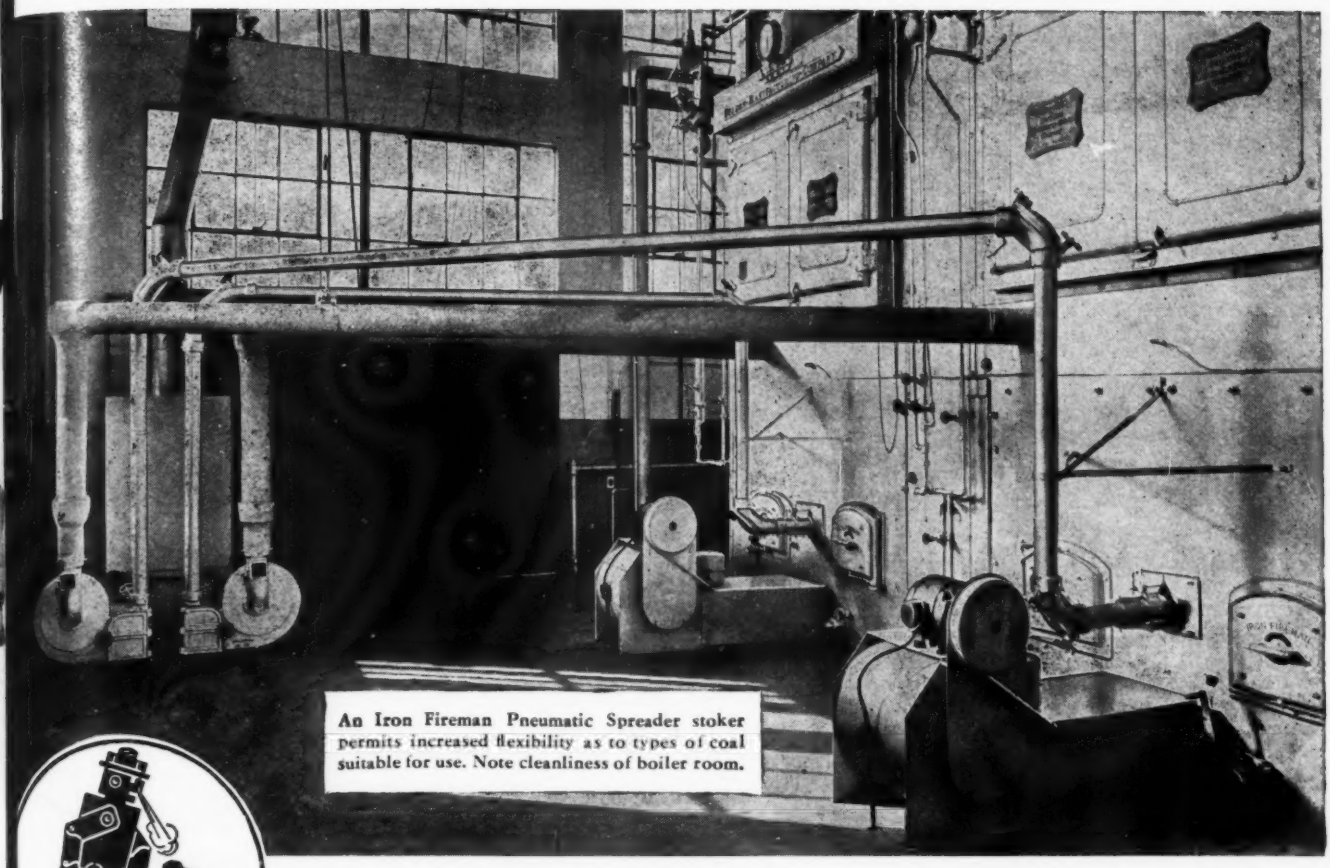
Convert to Automatic Coal Firing Now

If your power or heating plant is now oil-fired, or if you operate an essential business or industry, you are eligible to apply for an Iron Fireman stoker under WPB regulations.

Phone, wire or write Iron Fireman Manufacturing Company, 3504 West 106th Street, Cleveland, Ohio.

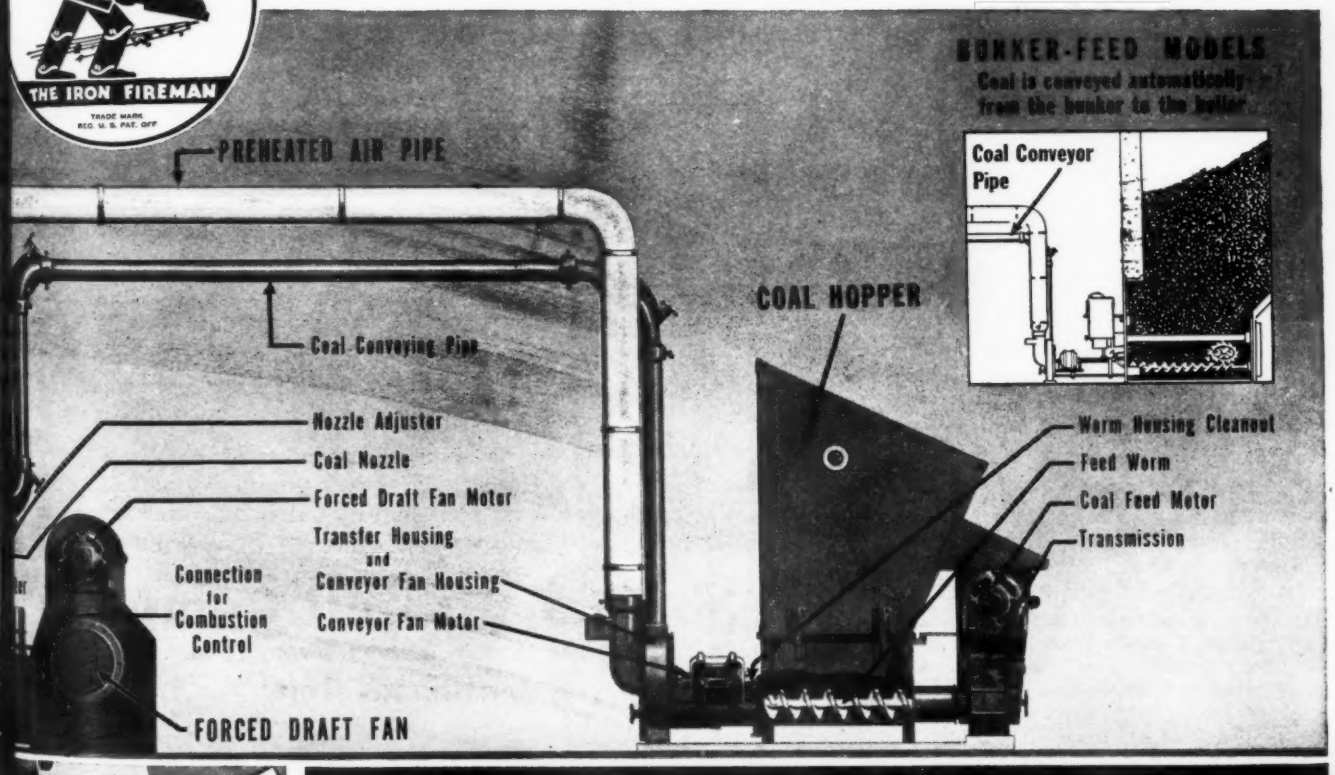


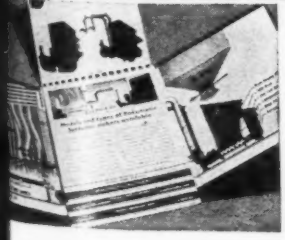
IRON FIREMAN
THE IRON FIREMAN
Automatic Coal Stokers



An Iron Fireman Pneumatic Spreader stoker permits increased flexibility as to types of coal suitable for use. Note cleanliness of boiler room.

THE IRON FIREMAN
TRADE MARK
REG. U. S. PAT. OFF.





FREE BOOK on Pneumatic Spreader Firing

Contains full descriptions, capacities, operating data, etc., with layouts and photos of 10 actual installations. Sent free, on request. Write to Iron Fireman Mfg. Co., 3504 W. 106th Street, Cleveland, Ohio.

Fig. 375—Bronze Gate Valve for 200 pounds W. P. Has screwed ends, union bonnet, inside screw rising stem and a special hard bronze disc.

Beginning of a long life in the POWELL Line

Before a Powell Valve earns the right to bear this time-honored name, it is called upon to prove its acceptability into an illustrious family. In blunt words, it must fill a need—actual or anticipated—before it is permitted the responsibilities of the family name.

From the moment of its conception by Powell engineers and consultants, that valve is engineered to its purpose. It must meet every requirement of "Standard for Control", which is the family motto.

This goes for *all* Powell Valves . . . of every type . . . of every proved-in-service material . . . for every need. Powell takes this special care because its near-century-old name rests upon the *pre-determined performance of every Powell Valve.*

The Wm. Powell Company

Dependable Valves Since 1846

Cincinnati, Ohio

POWELL

The complete POWELL Line includes Globe, Angle, Gate, Check, Relief, Y, Non-Return and other types of valves in bronze, iron, steel, pure metals and special alloys to meet the demands of all branches of Industry for DEPENDABLE FLOW CONTROL EQUIPMENT.

Fig. 500—Bronze Gate Valve for 125 pounds W. P. Has screwed ends, screwed-in bonnet and taper-wedge solid or double disc.

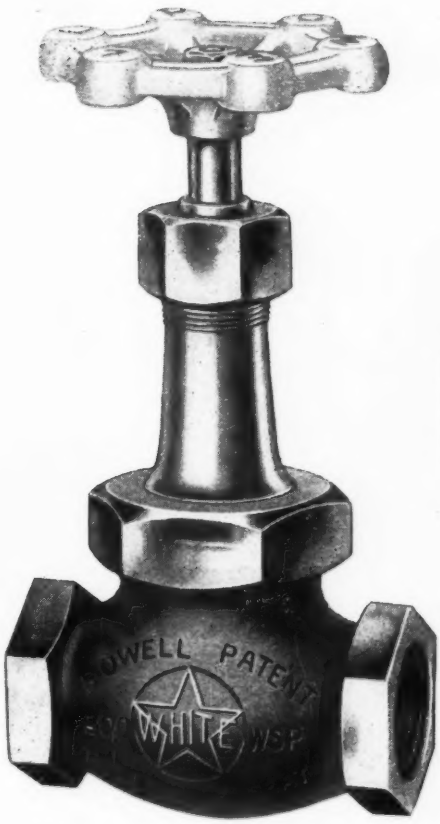


Fig. 1708—Bronze Globe Valve for 200 pounds W. P. Has screwed ends, union bonnet, renewable seat and regrindable, renewable hard bronze semi-cone, plug type disc.

Fig. 150—Bronze "Union Disc" Globe Valve for 150 pounds W. P. Has screwed ends, union bonnet, and renewable, vulcanized composition disc.

Powell Bronze Globe and Angle Valves, in sizes up to and including 3" are especially adapted for throttling service—for the control of low-pressure steam, oil, water, gas, etc.

VALVES

Progress and Power in the

Hats off to America's Magnesium Industry! Deprived of foreign sources of supply and faced with the unprecedented demands of global war, the industry rose magnificently to the occasion . . . prospected and developed new ore fields . . . created new methods of extraction almost overnight.

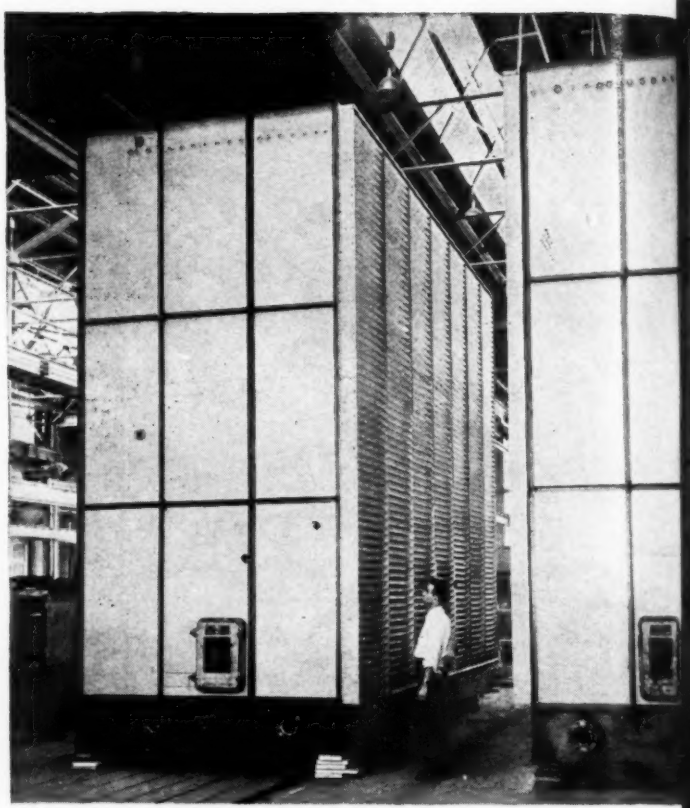
Throughout this crisis American Blower has strained every effort to share the load. In the magnesium plants and in the public utilities that provide them vital power, our Mechanical Draft equipment and Fluid Drives have played an increasingly important part.

We at American Blower are ready and alert for those post-war years when the Magnesium Industry and the public utilities of the nation will call upon our 60 years of engineering skill to aid in world-wide restoration.

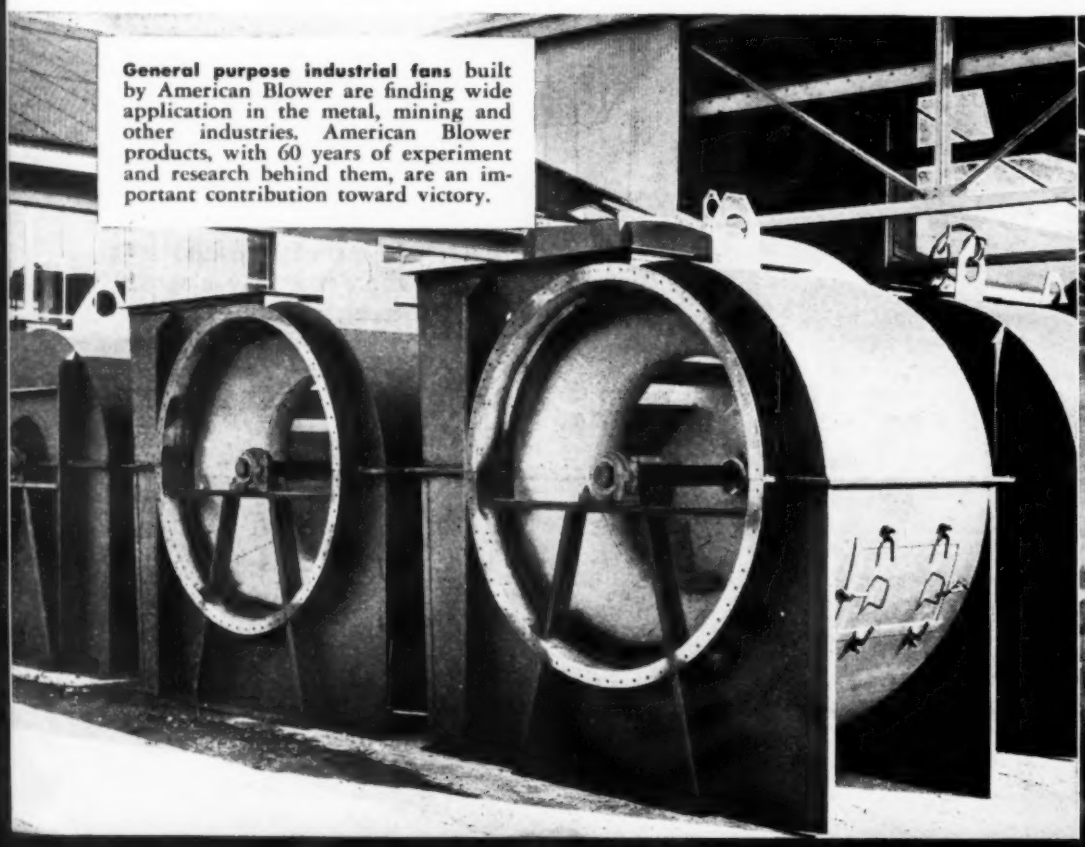
AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American Radiator and Standard Sanitary Corporation

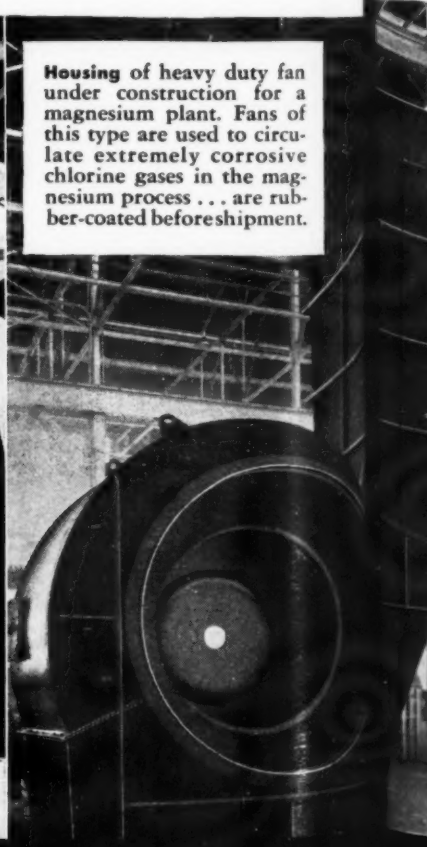
ARMY E NAVY
For excellence in production.



Giant washers for cooling and purifying air are essential equipment in process buildings where magnesium is extracted from its ore. American Blower washers of many sizes and types are custom-built to meet particular requirements of war industries.

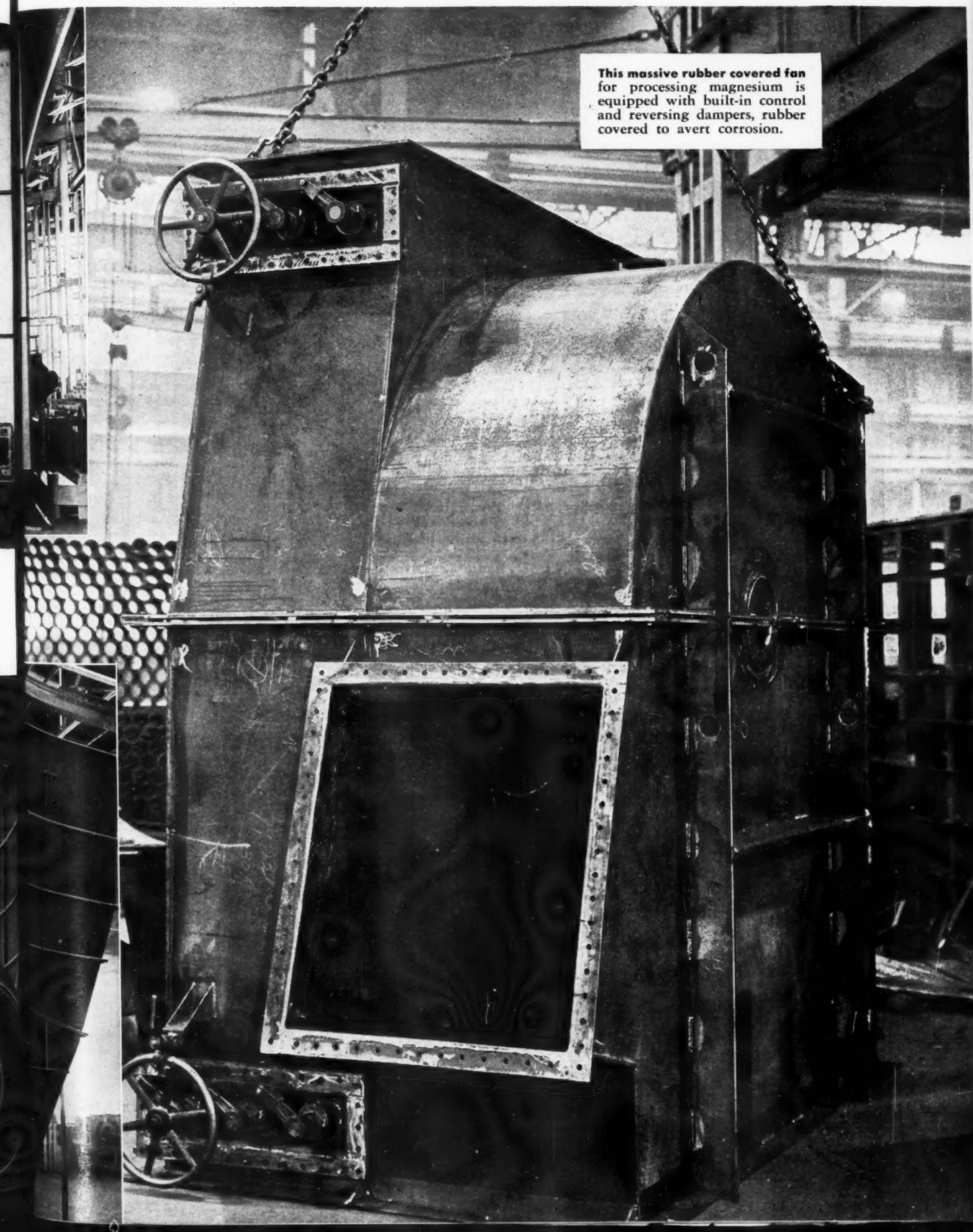


General purpose industrial fans built by American Blower are finding wide application in the metal, mining and other industries. American Blower products, with 60 years of experiment and research behind them, are an important contribution toward victory.



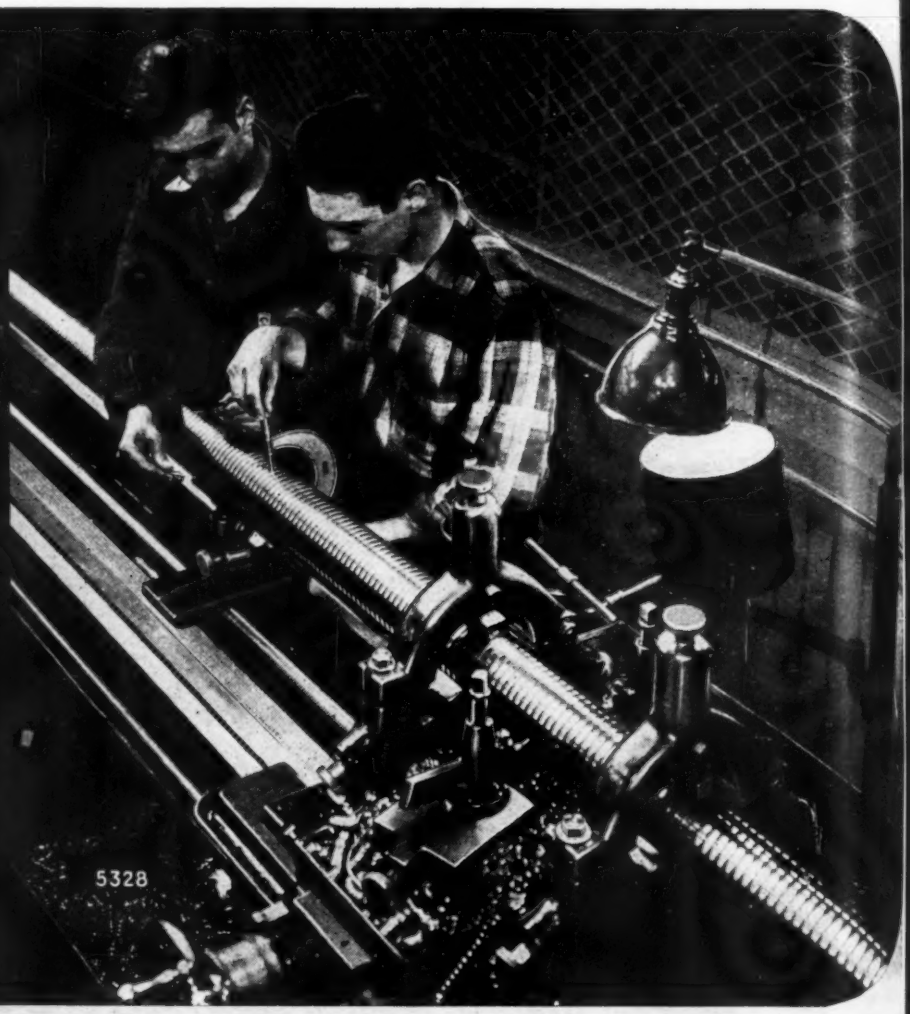
Housing of heavy duty fan under construction for a magnesium plant. Fans of this type are used to circulate extremely corrosive chlorine gases in the magnesium process . . . are rubber-coated before shipment.

MAGNESIUM INDUSTRY



This massive rubber covered fan for processing magnesium is equipped with built-in control and reversing dampers, rubber covered to avert corrosion.

THE *Master* LEAD SCREW



Making a Precision Lead Screw

The lead screws used in the gear generating machines which produce De Laval Helical Gears for transmitting the power of high-speed steam turbines and also in the thread milling machines on which the worms for De Laval worm gears are made must be extremely accurate, since tolerances are measured in ten-thousandths of an inch.

Lead screws of the precision required not being generally available, it has from the beginning been the practice of the De Laval Steam Turbine Company to cut its own lead screws. The precision lead screw cutting lathe here shown, after exhaustive checking and the incorporation of certain refinements by our engineers and shop specialists, produces lead screws of the necessary accuracy.

The machine's own carefully corrected original or master lead screw is protected and carefully preserved. A duplicate which has been cut from the original and can readily be replaced when worn or injured is used in regular operation.

This is one of the factors contributing to the outstanding success of the many millions of horsepower of De Laval Gears now in service upon American Naval and merchant vessels and in industrial applications.

M-35

De Laval STEAM TURBINE CO.
TRENTON 2, N.J.

MANUFACTURERS OF TURBINES . . . STEAM, HYDRAULIC; PUMPS . . . CENTRIFUGAL, CLOGLESS, ROTARY DISPLACEMENT, MOTOR-MOUNTED, MIXED-FLOW, PROPELLER; PRIMING SYSTEMS; CENTRIFUGAL BLOWERS and COMPRESSORS; GEARS . . . WORM, HELICAL; and FLEXIBLE COUPLINGS

JULY 1943

POWER

VOLUME 87
NUMBER 7

N O WYNKOOP, *Publisher*

PHILIP W SWAIN, *Editor*

Associate Editors: F A ANNETT
S A TUCKER L N ROWLEY JR

Assistant Editors:
E W FELLER G A KEATES

Paul Wooton, *Washington*
G C Tenney, *San Francisco*
H S Knowlton, *Boston*

Business Manager: E J TANGERMAH

Eugene, Oregon plant learns from experience	64
Refrigeration facts for apprentice engineers, 2	67
Check lubricants to make them last longer	69
Fewer hours to repair turbine casing by welding	72
Here's how to put drag scrapers to good use	74
Maintenance keeps electronic controls on the job	76
Recognize air compressor troubles by symptoms	79
Editor Swain visits power school in Kentucky	81
Diesels show good economy with low-grade fuels	84
" . . . before the lantern hit the ground"	87
An appreciation of J W Hays, combustion engineer	88
Pump under Fifth Ave regulates water pressure	89
Electronic controls power variable-speed drives	92
Reminiscences of the Old Chief—Creeping Jimmy	94
Wartime Power Clinic—emergency repairs	95
Use steam-driven auxiliaries to best advantage	99

THE OPERATING ENGINEER

Skimp pipe and valve size for the duration	102
An unusual governor setup to argue about	104

Refrigeration, 4	105	Practical Aids	106
Readers' Problems	110	Questions, Answers	114
Horizontal welds	120	Argument Corner	122

OTHER DEPARTMENTS

New Equipment	124	George Edwards	128
Power Lines	130	Data Sheet	134

VOLUME 87, NUMBER 7 • A McGRAW-HILL PUBLICATION • COPYRIGHT 1943, By McGRAW-HILL PUBLISHING CO, INC

James H McGraw, Founder and Honorary Chairman; James H McGraw Jr, President; Howard Ehrlich, Executive Vice-President; Mason Britton, Vice-President; B R Putnam, Treasurer; A Gerardi, Secretary; J E Blackburn Jr, Director of Circulation • District Managers: New York, S H Quarles; Philadelphia, C R Long; Cleveland, F B Gobley; Chicago, Boughton; Boston, C L Morton; St. Louis, G G Sears • Editorial and Executive Office: 330 West 42nd St, New York, N Y • Publication Office: 99-129 North Broadway, Albany, N Y • Cable Address: "McGrawhill, New York" • District Offices: Chicago, 520 North Michigan Ave; San Francisco, 68 Post St; Washington, National Press Bldg; Philadelphia, 16 South Broad St; Cleveland, 1510 Hanna Bldg; Detroit, 2-144 General Motors Bldg; St Louis, 1066 Paul Brown Bldg; Boston, 1427 Statler Bldg; Atlanta, 1011 Rhodes-Haverty Bldg; London, Aldwych House, Aldwych, London WC2 • POWER articles are indexed in both the Industrial Arts and the Engineering Index, at public libraries

GET THE FACTS ON THIS

CHECK CHART

FOR SINGLE-RETORT STOKERS

OPERATING AND MAINTENANCE HINTS FOR EFFICIENT OPERATION AND MINIMUM OUTAGE

INSTRUMENTS

DRAFT GAUGES—Watch carefully and check to assure correct indication of operating conditions.

STEAM AND FEED-WATER METERS—Operate with careful attention to manufacturers' instructions. Watch for load changes and adjust stoker operation for maximum economy.

STEAM FLOW—AIR FLOW METERS—Check and correct by comparison with gas analyses obtained with an Orsat apparatus. Too little air will damage stokers and cause smoke. Too much air will lower efficiency.

AIR REQUIREMENTS

PROPER AIR-FUEL PROPORTION—Proper proportion gives efficient combustion, less labor handling coal and ash, and fewer shutdowns to replace burned grates.

TOO LITTLE AIR...TOO MUCH FUEL—Too little air and too much fuel wastes heat of partially burned fuel. Red hot grates result; grates burn, ash melts and forms large sticky clinkers, fuel bed mats over and makes air pressure rise. Where air can get through fuel bed, it travels fast and causes smoke.

TOO MUCH AIR...TOO LITTLE FUEL—Too much air and too little fuel wastes heat, requiring more coal and producing more ashes. Excess air keeps the grates cold and cools hot gases.

OPERATION

SEE THAT DRAFT IS ADEQUATE—Where boilers are operated at high ratings, lack of adequate draft causes more burning of stokers, more burning of brickwork, more clinker trouble and smoke than any other factor encountered in boiler operation. Operate stoker with fairly uniform excess air over its entire area. Watch for leaks.

FUEL DISTRIBUTION

SPREAD EVENLY—Adjust stoker operation to distribute coal over the grate surface so that actively burning coal covers all areas where air is flowing.

SPREAD TO PROPER DEPTH—Keep a fuel bed of a thickness such that intimate mixture of the coal and air occurs at all points without "holes" developing.

ASH AND CLINKERS

PROTECT GRATES—Keep some ash on stoker grates to act as an insulator.

MOVE ASH—See that ash is moved to discharge section as fast as new ash is deposited.

BOILER AND FURNACE STRUCTURE

EXAMINE FOR POSSIBLE LEAKS—Check expansion joints in brickwork. Check places where boiler drums, water wall circulators, water wall headers, superheater tubes or headers, etc., pass through brickwork. Check places where brickwork is built around columns or beams.

Check joints in steel casings.

Check joints between water wall casings and brick walls.

Check setting of doors and frames.

Check wall sleeves for soot blowers.

AUTOMATIC REGULATION

STEAM PRESSURE REGULATOR—Keep changes in rate of air flow and coal feed in step, to require only small adjustment for operation within a pressure variation of about five per cent.

FEED-WATER REGULATOR—Uniform flow of feed water is essential to good regulation. Suddenly reduced flow causes rapid rise in steam pressure. Sudden inrush of feed water causes a sharp drop in steam pressure.

LINK-GRATE STOKERS

STARTING FIRE—If the coal has an ash content of less than 7 per cent cover the grates with a layer of ashes about 1" thick before laying the fire. Spread coal manually to uniform 3" depth. Keep coal in the hopper at all times when the boiler is under load. Operating with empty hopper may damage the retort.

MAINTAINING FUEL BED—Adjust secondary ram stroke to distribute coal uniformly from front to rear. Abate stoker by shutting off power when changing secondary ram stroke.

DUMPING ASH—Do not follow a fixed schedule for dumping. Dump when the accumulation of ash over the dump grates is sufficient to be well burned out but before it retards the movement of the fuel bed and clinkers form.

Stop the stoker and reduce air pressure to not over 0.5" while dumping. Drop dump grates then raise before banking into furnace. Do not rake ash and fuel from stationary plates or moving grates; knock adhering slag from side wall with dump grate up. Be sure dump grates are securely latched.

BANKING—Do not dump ash just before banking. Before banking, burn fire down thinner than normal. Run hopper empty before banking, or if necessary run stoker several strokes every hour after banking to empty hopper without building up fuel bed excessively.

After stopping stoker (with ram on "in" stroke) and cutting off forced draft, close the boiler damper gradually as the furnace cools.

PRECAUTIONS

WATCH DRAFT—Maintain a draft in the furnace of 0.05" to 0.10" at all times, including banking.

CHECK SLAG—Keep the furnace walls free of slag accumulations which may interfere with movement and combustion of the fuel.

LUBRICATE REGULARLY—Fill automatic lubricators, check oil feed, and grease the moving parts daily. Wash the grate driving mitre gears with heavy oil and graphite daily.

CHECK WINDBOX—Remove sifting-cients frequent to prevent interference with air flow.

Westinghouse

STOKERS

HELP FOR THE BOILER ROOM...
Post this Check Chart which gives helpful operating and maintenance hints to hold top stoker efficiency.

Westinghouse Stokers

STOKER MAINTENANCE PROGRAM TO ASSURE TOP PERFORMANCE

Here's what you need to give your Westinghouse single-retort stokers the special wartime care they deserve. To help you, Westinghouse has assembled a storehouse of practical information—put in easily usable form.

Follow the four steps below. You'll find these helps will greatly simplify the important job of keeping your stokers operating at peak efficiency.

For top stoker performance, continued production, and low-cost operation—get the facts on this program *now.*

J-50436

1 **SEND FOR OPERATING GUIDE AND CHECK CHART**—which give basic operating and maintenance information on Westinghouse single-retort stokers.

2 **TELL YOUR MAINTENANCE MEN**—about the importance of this program, and outline the plan.

3 **SET UP REGULAR INSPECTION PERIODS**—covering all points included in Operating Guide and Check Chart.

4 **SET UP INSPECTION RECORD SYSTEM**—using the inspection summary suggested in the Operating Guide.

WESTINGHOUSE

PLANTS IN 25 CITIES • OFFICES EVERYWHERE

Westinghouse Elec. & Mfg. Co.,
Dept. 7-N, East Pittsburgh, Pa.
Send to me:

_____Copies Operating Guide, 48-page pocket-size manual, B-3257.

_____Copies Maintenance Check Chart 16½"x21½", DC-237.

Company _____

Attention _____

Address _____

City _____ State _____

If you'll stop and think how much just one extra year of trouble-free service from your stacks and breeching would be worth right now, you'll understand why so many smart plant engineers are building and repairing all flue gas conductors with Byers Wrought Iron . . . and why it will pay you to use it.

Smoke is bound to contain CO_2, and almost always carries sulfur compounds. When these are absorbed by moisture, they form highly corrosive acids. The exact degree of corrosion can't be forecast over any long period. A change in fuel may increase the harmful elements. Or installation of an economizer may lower stack temperatures below the dewpoint, and speed up acid formation. Or the use of steam injection, or excessive watering of the fuel, may aggravate conditions. The resulting corrosion can't be controlled; *it must be combated.* And the experience of hundreds of practical plant men indicates that the safest, surest way is by using Byers Wrought Iron.

The time to solve stack maintenance problems is when you select materials

BYERS WROUGHT IRON

The illustration shows an example: one of two stacks erected in 1909 by a large eastern manufacturer. The original wrought iron sections are still serving, while similar sections of ordinary materials failed in a short time.

The resistance of Byers Wrought Iron is due to the purity of the base metal, and to its unique iron-slag structure. Corrosive attack is not only resisted, but *diffused.* This avoids the localized pitting that usually causes failures of low first cost materials.

If you are concerned with the building or repair of any stacks, you will find some very helpful information in our Bulletin, "Wrought Iron for Flue Gas Conductors and Coal Handling Equipment." We will be very glad to send you a copy. In case you want additional information or reports on some specific application, just ask our Engineering Service Department.

A. M. Byers Company. Established 1864. Offices in Pittsburgh, Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

BYERS

GENUINE WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE ALLOY STEELS · OPEN HEARTH ALLOY STEELS · CARBON STEEL TUBULAR PRODUCTS

ESTABLISHED IN 1882 POWER PHILIP W SWAIN, EDITOR

PEACETIME PREDICTION

AS PEACE GETS CLOSER, each engineer must start re-planning his own power plant to meet his future local requirements. Yet this planning can't be strictly a home-town job. Until he has roamed far afield he will never find the right answers in his own back yard.

First he sees that his selection and arrangement of power machinery must depend on what's ahead for the plant and industry he serves. That, in turn, will be tied to the general level of post-war production. Will it be slow moving, average or booming?

At the end of the road he will find himself forced to study national post-war markets before he can correctly answer simple questions about his own equipment. Who buys what in 1946—and how much—will finally determine the local demand for his kilowatts, steam and compressed air.

Engineers seeking this essential post-war business guidance will find the unfamiliar trail clearly marked in an outstanding new publication of the Department of Commerce, "Markets after the War —An Approach to Their Analysis" by S. Morris Livingston. Here are some of the milestones (the language is ours):

Let's compare 1940 and 1946, 1940 standing for pre-war and 1946 for post-war. In 1940 employed workers numbered 46 million, unemployed 9 million, despite which national production was higher than in any previous year of American history.

What would have to happen to bring unemployment in 1946 down to an "irreducible minimum" of, say, two million, assuming the average working hours of 1940 and the normal growth of worker population and efficiency? The answer works out to a 46% production increase over 1940. Gross national product in 1940 was 97 billion dollars. On the basis of the listed assumptions the 1946 national product would be 142 billion dollars at the 1940 price level or 165 billion at the 1942 price level.

This is a pretty picture: what chance has it of happening? Could our people consume this volume of goods? Could they find the money to pay for them?

The need for products is assured. Depression and War have left vast gaps in the civilian economy. Americans everywhere will have use for enough new housing, cars, radios, furniture, appliances and so on to keep the national productive capacity busy for years.

Will the people have the money to pay for these goods? This, too, is easy. Large-scale production produces its own buying power in wages and salaries. With it, to start things rolling in a big way, will be a vast nest egg of personal wartime savings totalling probably 100 billion dollars by the end of 1944.

Before 1941 the yearly individual savings of Americans never reached 10 billion dollars. Since then the figures are 13.7 billions saved in 1941, another 26.9 in 1942 and 43.0 billions more (estimated) in 1943. Of these wartime savings from 40 to 60 billion dollars will normally be looking for something to buy when the goods are made available.

This report leads reasonably to the expectation that post-war wages and salaries, plus many billions of wartime savings, will actually be spent for enough goods and services to sustain for many years a gross national production of 165 billions in terms of 1942 dollars.

Three things are sure: (1) This goal is mechanically and humanly attainable; (2) its attainment is essential to avoid devastating unemployment; (3) in no other way can America carry the vast war debt without excessive strain.

Finally, let's never forget that neither high dollar income nor full employment can make a healthy national life unless the dollars are good for buying valuable things and the employment effective in producing them. Inflation and inefficiency must be held in check. We shall live well and safely in 1946 by real production, not by the multiplication of dollar signs or leaf raking.

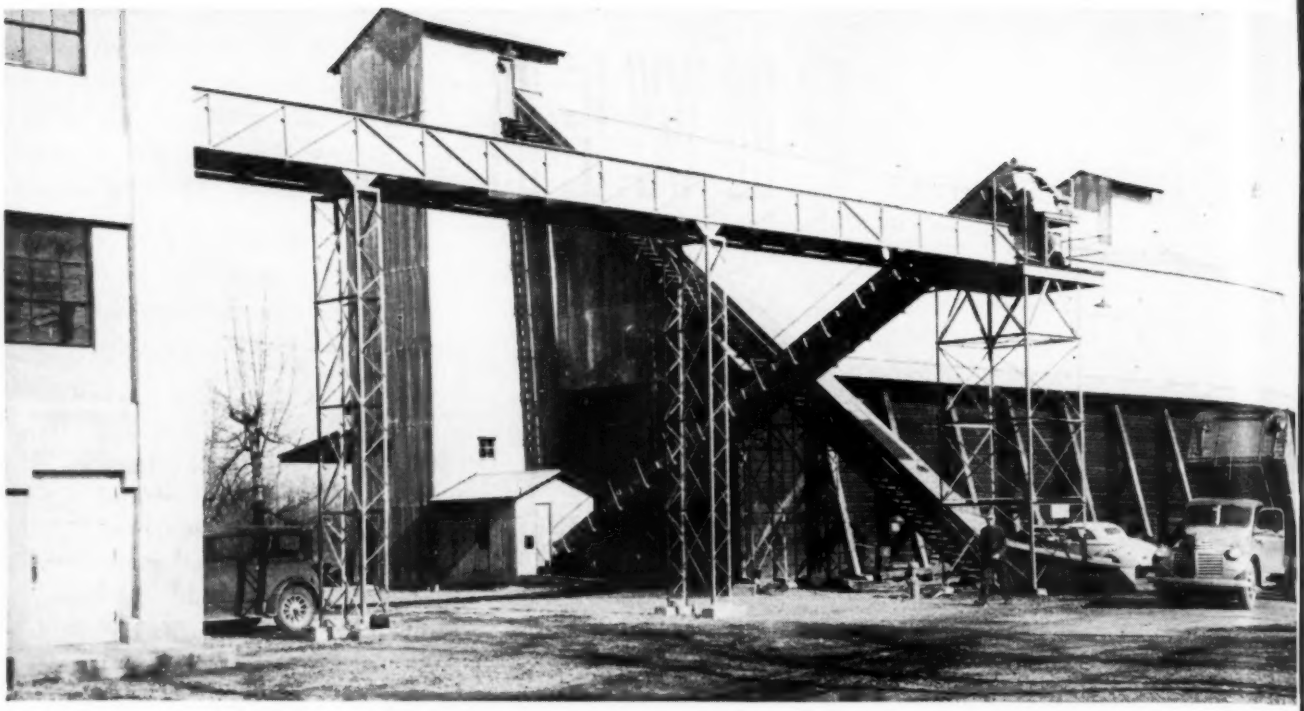
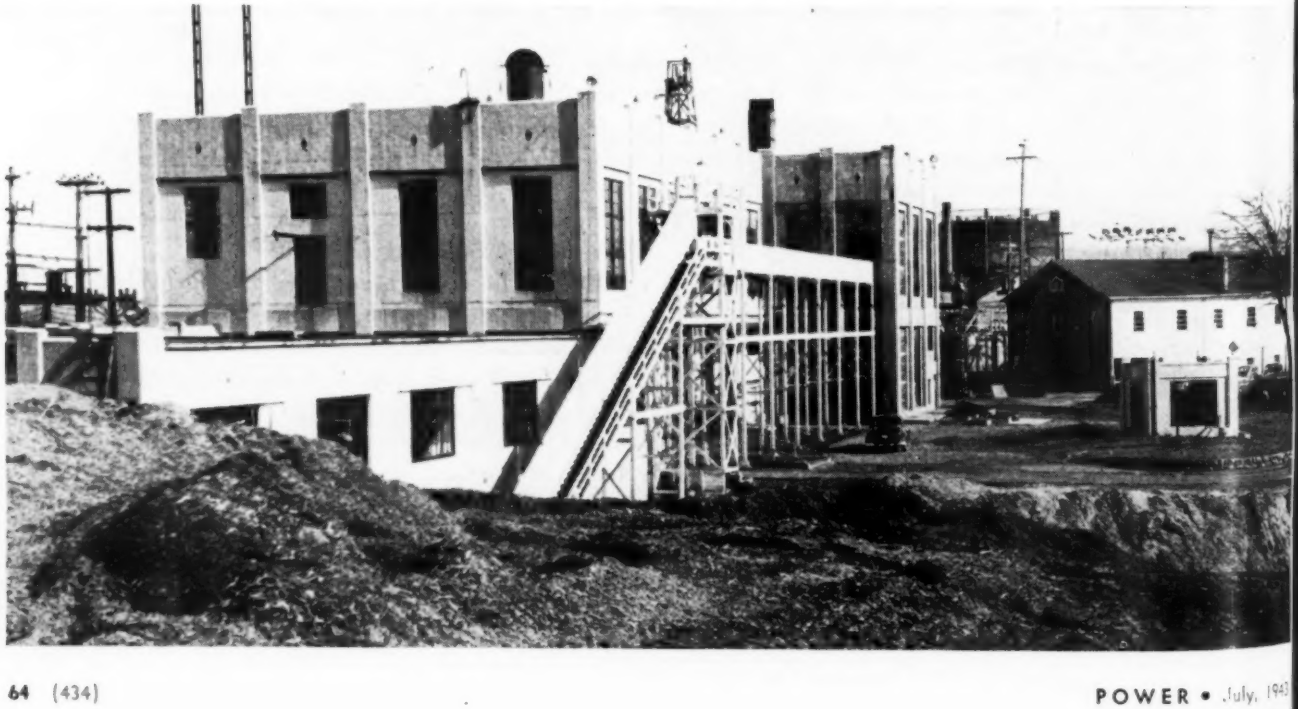


Fig. 1—Conveying systems deliver trucked fuel into the fuel house; from there it goes to the boiler-room as needed

Eugene, Oregon's New Plant Cashes In on Old System's Experience

An addition to the original steam plant gives a good account of itself in tests and performance, as set down by R B Boals, Eugene Water Board. The reasons for selecting this power source. using wood waste as fuel, makes an interesting story

Fig. 2—A tractor scraper moves wood fuel from the large storage pile in foreground to the boiler-room conveying system



▶ THE CITY OF EUGENE, on the Wilamette River in Oregon's fir and cedar country, needed an additional power source for its growing population, which is now over 20,000. Here is our step-by-step solution of the problem.

Before 1940, the city received power over transmission lines from two hydro plants with a total capacity of about 9000 kw, backed up by a standby steam station. Although the larger of the two hydro plants was designed and built for two 7500-kw 80%-pf generators, it contained but one.

The steam plant is situated in the city of Eugene itself. When it was built in 1930, we installed one turbine-generator of 7500 kw at 80% pf and one boiler. The boiler was designed for 250 psi and 600 F and, although the setting was laid out to use wood or other solid fuel, it had only oil-burning equipment. Oil proved more economical because steam power was not often needed. As a matter of fact, to keep up steam in the boiler a conductivity-type electric heater used dump hydro power that was available most of the time from 1930 to 1940.

In line with accepted practice, plant engineers followed the policy of maintaining sufficient spare generating capacity to meet maximum system requirements with the largest unit out of service.

In 1937, the system load was rapidly approaching a point where the two hydro plants could no longer carry the system peak. Although the average annual system load factor was only 50%, rate of peak-load growth had averaged approximately 750 kw per year over the life of the system. Studies begun at that time indicated that a new energy source, with capacity to carry normal peak growth for ten years, would be satisfactory.

Four possibilities for new power were: (1) buying power from outside sources, such as the Columbia River Hydro Development, then under construction, (2) installing diesel-engine generators locally, (3) adding to the hydro capacity, and (4) adding to the steam-plant facilities.

Costof the first alternative, buying power outside, was found to equal that of local fuel-generated energy, when we considered load factor together with dependency on a long transmission line.

Second possibility, a diesel installation, offered serious competition to steam power, but was lacking in two important respects: (a) It required a particular fuel, and (b) units could not be used interchangeably with boiler and turbine-generator already installed.

Third, a second hydro, would have meant minimum expense, but river flow would operate both units at capacity only about 65% of the time. Therefore, capital cost of an entirely new hydro plant for peak and emergency service was not justified.

Early in 1940, we selected the fourth possibility, and started construction on an addition to the present steam plant, to house an additional boiler and 7500-kw turbine-generator.

Because of the abundance and comparatively low cost of local waste wood, the new boiler was to be equipped for wood firing, with oil burners for emergencies. To permit interchangeability, the new boiler, although constructed for 300 psi working pressure, would operate at 250 psi and deliver 725-F steam.

Installed were: (1) a 120,000-lb-per-hr type-F Babcock & Wilcox boiler, furnished by C C Moore Co, complete with water-cooled grates, air heater, Bigelow-Liptak supported-wall construction and B & W oil burners. (2) a Westinghouse 7500-kw 70%-pf 4-bearing turbine-generator, together with a single-pass condenser and auxiliaries by the same company. Condenser tubes are rolled at both ends and piping connections permit reversal of flow for cleaning. Condenser circulating-water pumps of the turbine type handle 8000 gpm each, or about 13,000 gpm in parallel, (3) one turbine- and one motor-driven circulating-water pump.

Fuel-handling equipment permits storage of about 1000 units (200 cu ft each) of wood waste. We expected fuel use to increase gradually from about 1300 units in 1941 to about 15,000 in 1950. Conveying equipment capacity was adequate to handle 20 units per hr, or sufficient to take care of a second future unit of equal capacity.

The fuel house provides a useful storage area of 60x120 ft, with 20-ft vertical side walls. A hipped roof, with modified scissor trusses on 10-ft centers, clears the fuel pile, which has a 45-deg angle of repose. Buttress columns, at 10-ft intervals around the building, stiffen the walls against horizontal pressure. Fuel is distributed in the house by means of ploughs at 10-ft spacings, which ride the fuel belt and remove fuel as desired. Fuel reclaiming takes place on a belt in a trench that extends the length of the building down the center of the floor. A bulldozer pushes fuel in from the sides. A thin asphalt-macadam floor was placed after the ground settled under the completed building.

All conveyors, except two 30-in. belts inside the building, use forged rivetless chain, two strands of which ride on plywood wearing strips and support 2x6x24-in. flights, spaced at 36 in. for horizontal runs and at 24 in. for inclined runs.

Fuel from the storage house discharges into an auxiliary 12-unit capacity bin located above the firing deck

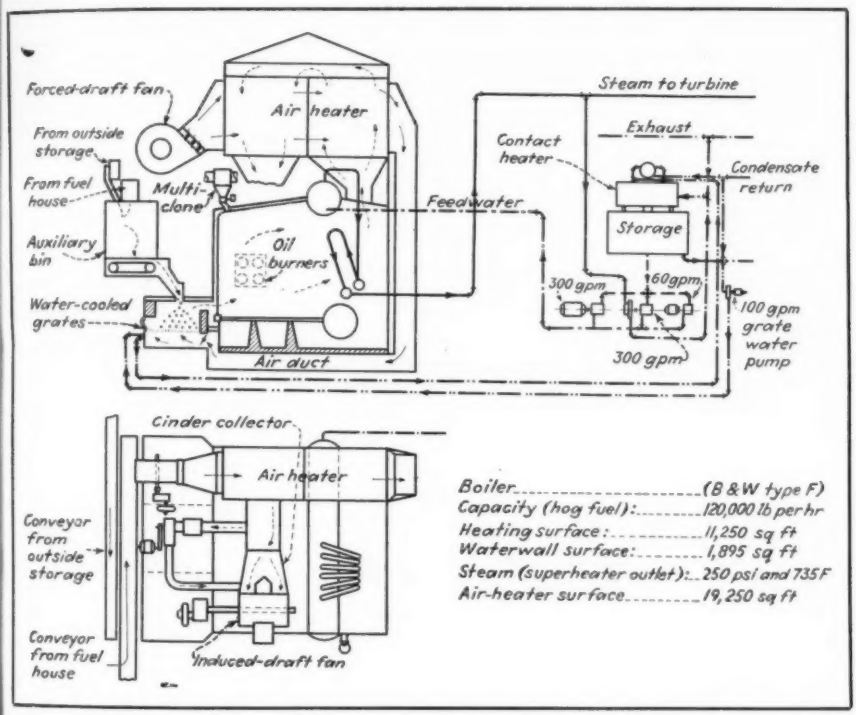


Fig. 3—Dutch-oven water-cooled grate supplies heat to the feedwater. Multiclone collects cinders and delivers them to the combustion chamber where they are consumed

in the boiler room. Feeder chains, each located in a separate hopper section at the bottom of the bin, carry and drop the fuel into three furnace-feed chutes. Feeder conveyors are driven by a 2-hp gearmotor directly coupled to a 4-speed truck transmission driving a countershaft through a roller chain. Another roller-chain drive connects the countershaft through a jaw clutch to each individual feeder drive which consists of another 4-speed truck transmission. This provides a total of 16 speeds: four countershaft speeds and a second 4-speed selection for each feeder. The feeder conveyor chain proper consists of two strands of No. 78 chain which carry angle flights 1½x2½x¼x36 in., spaced at about 36-in. centers.

After installing the initial fuel-handling equipment early in 1942, we found that load demand on the plant would greatly exceed the original forecast. This increase, coupled with seasonal availability of wood-waste fuel—a condition becoming more pronounced because of the oil shortage—demanded storage in greater quantity than fuelhouse capacity permitted. We therefore pressed into service a section of plant ground, approximately 130x350 ft, for storage of 4000 units, and installed an entirely new set of conveyors to move the fuel into the boiler room. The box-link conveyor chain, bought from a dismantled mill, is made up of ½x2-in. strap iron in lengths having a pitch of 8 in. and a width of about 14 in. outside the binder bars.

Truck Delivery

Trucks dump fuel directly on the pile. Reclaiming as well as final placing is accomplished with a small diesel-driven tractor fitted with a dozer blade. Since the horizontal reclaiming conveyor that receives fuel from the dozer is about 90 ft long at the loading point. the tractor does not have to push fuel more than 150 ft at the remotest point from the conveyor.

While our experience with this fuel is rather limited, we do not believe that deterioration in the outdoor pile will be serious through one season, even though there appears to be a gain in moisture at considerable depth within the pile. Spotted heating occurs in stored fuel both indoors and outdoors. On inside storage, temperatures have been found up to 160 F. In the outside pile, 160 F is usual but temperatures have been found up to 195 F. After a few months' storage inside, fuel has an appreciable drop in moisture.

Fuel from the bunkers flows to three Dutch ovens each fired through one

(*Continued on page* 136)

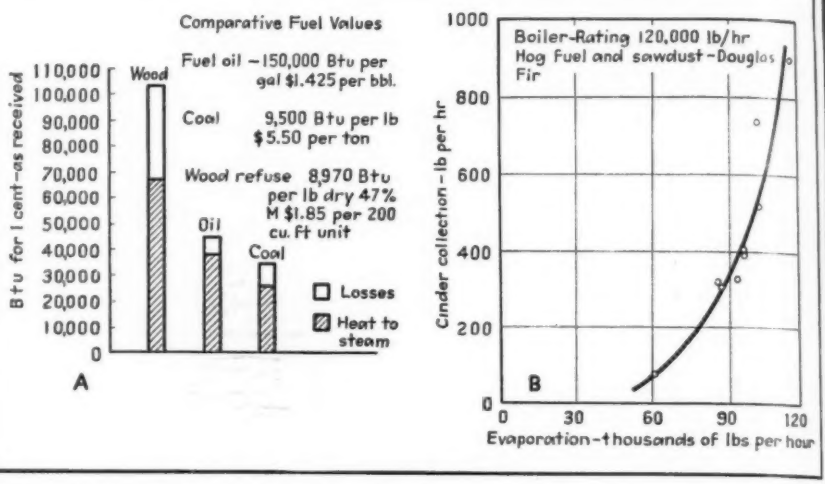


Fig. 4—(A) Cost of available fuels compared on heat-value basis. (B) Cinder carryover and therefore collector load increases in proportion to the boiler steaming rate

TEST DATA FOR BOILER NO. 2

(Averaged Readings)

BOILER

Forced-draft positive pressure

	in.H_2O
Air to heater	1.35
Air from heater	0.535
Ashpits	0.21

Induced-draft negative pressure

	in.H_2O
Furnace	0.21
Gas to heater	1.01
Gas from heater	1.35
Gas to fan	2.56

Temperature

	F
Air from heater	433
Gas to heater	528
Gas from heater	344
Steam from superheater	670
Feedwater to boiler	248.4
Dry bulb–boiler room	93.4
Wet bulb–boiler room	72.0

CO_2 ..... 13.4%

Fuel cone height ..... 5 ft

Steam pressure ..... 240 psi

TURBINE-GENERATOR

Temperature

	F
Entering steam	678
Exhaust steam	76.6
Condensate	91.1
Condensate: lv, bldr, htr	198
Cooling water, in	52.5
Cooling water, out	60.0
Steam, bled to htr	204

FUEL

(Fir with some cedar and hemlock — hog fuel and sawdust)

Truck loads	54
Moist samples	54
Units	129.5
Moisture as fired	47.9%
Assumed Btu dry	8970

CINDER COLLECTOR

Skimmer draft loss	1.05 in. H_2O
Collection	83 lb per hr

QUANTITIES AND COMPUTED PERFORMANCE

Duration of test	27.33	hr
Reading interval	20	min
Weight of fuel fired	579,535	lb
Kwhr generated	141,500	
Evaporation	1,590,000	lb
Steam to turbine	1,505,000	lb
Kwhr, per unit	1,090	
Boiler efficiency	67.57%	

FUEL DATA

Source	*Kind*	*Units*	*Average weight dry, per unit-lb*	*Relative value %*
A	Fir:hog	18½	2406	92.8
B	Fir:hem-cdr	32	2027	78.3
C	Fir:hog	21	2522	97.25
D	Fir:hog	4	2075	80.0
E	Fir:hog	29½	2593	100.0
F	Fir sawdust	24	2268	87.5

Spotlighting Refrigeration Facts for Apprentice Engineers—2

Keep a sharp lookout for small troubles that loom big by lowering the heat transfer rate, says A B Duryee. Here are operating tests and routine inspections, including a handy symptom-and-remedy chart that shows how trouble may spring from any of several causes

▶THE SECRET of a good maintenance program is eternal vigilance—checking many small items on a regular inspection schedule that you stick to. Automatic devices, in particular, show a healthy condition under such systematic care. Here are some pointers for a schedule.

Cleaning routine. Spotless equipment is pleasing to the eye and good for morale. Of more specific importance, the cleaning process shows up minor defects that might otherwise go undiscovered until breakdown occurred. When cleaning and inspecting sensitive control devices, follow the manufacturer's instructions.

Applying oil. Follow instructions, too, in adding oil. For instance, if instructions say not to apply oil, take the manufacturer's word for it and don't experiment. Rotating and reciprocating machines do, however, need lubrication. When adding oil use these approved methods:

To add oil to a compressor reservoir, open discharge valve on compressor, close suction valve and run machine three or four minutes to form a vacuum in the crankcase. Measure out required quantity of oil in a clean can, attach a hose to small oil valve on crankcase and insert free end in oil. Open valve so oil can flow into crankcase, but don't permit oil level to fall below hose end or air will enter the system. Meanwhile, you can stop the compressor or leave it running, provided a good vacuum remains in the crankcase. When compressor operates daily, drain and renew the entire oil charge at least every two months and clean oil strainers regularly.

Don't run with crankshaft stuffing box too tight. With proper adjustment, a slight trace of oil should seep through packing when machine runs.

Examine outboard bearings frequently during the day, and make sure they have plenty of oil and that oil rings are turning freely.

Dismantling. If compressor develops a knock, don't start to dismantle machine until you have checked for a loose flywheel. Keep crankpin bearings properly adjusted. At least once a year dismantle machine and give it a complete inspection. Valves should be ground in at this time. Use any good valve-grinding compound, but don't attempt to grind a wide flat contact on valve and seat; a small narrow ring is much better and prolongs valve life. Inspect and test valve springs, too. Strength of springs varies on different machines. Write the manufacturer for operating and maintenance instructions.

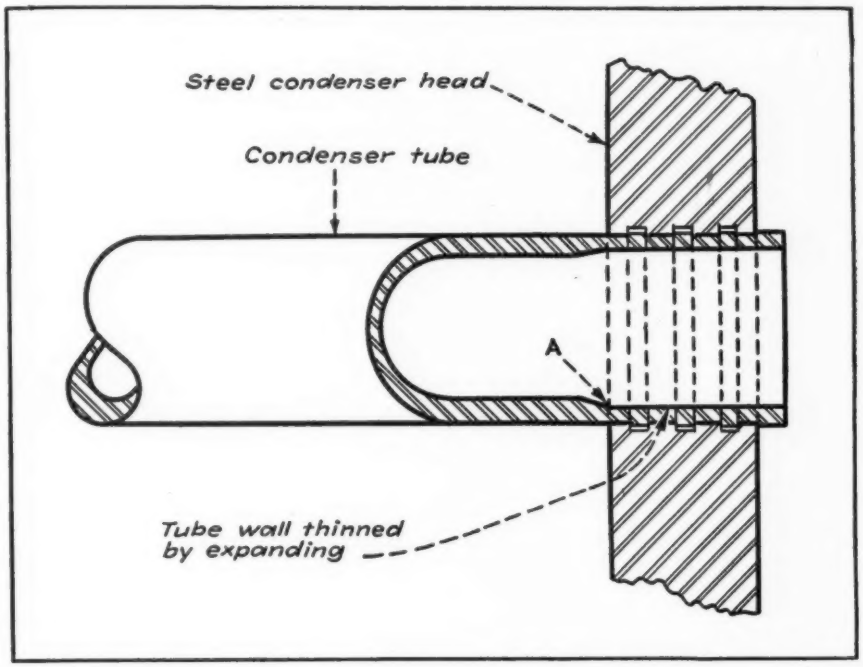


Fig. 1—Serious pitting usually occurs at point *A* where the tubes are rolled in the condenser head. Replace tube when its wall thickness is reduced one-half of normal

Before starting up compressor. Open the discharge valve wide and the suction valve slightly. If the machine does not start against full head pressure, use the bypass valve, thus: Close discharge valve, open bypass valve and start. After machine reaches full speed, begin opening discharge valve and closing bypass valve.

Purging. Do not purge when compressor is running. Best time is after plant has been shut down overnight. Air and foul gas have then had an opportunity to separate from refrigerant and rise to top of condenser where they can be drawn off. When purging, connect a short section of hose or pipe to the purge valve at top of condenser and insert free end in a bucket of cold water. Open valve slightly until bubbles start coming up through the water. These bubbles are air and foul gas. Disappearance of bubbles and heating of water, accompanied by a sharp, crackling noise, indicate ammonia discharge and no more purging is needed.

Scale and mud. Condenser water surfaces should be cleaned of scale and mud, usually, twice a year unless the water supply is exceptionally good. When cleaning, scrape the tubes and follow through with a brush and stream of water to remove all scum and mud.

Pitting and corrosion. When condenser is open for cleaning, examine

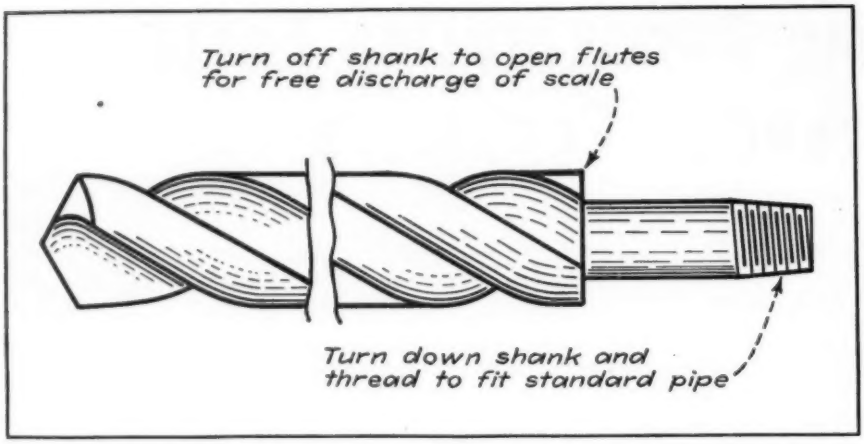


Fig. 2—A standard twist drill slightly smaller than the condenser tube easily removes hard deposits. An ordinary hand brace or homemade crank serves for turning the tool

Causes and Remedies of Refrigerating Troubles

Trouble	Cause	Remedy
High head pressure	Dirty condenser	Clean
	Air and foul gas	Purge
	Insufficient water on condenser	Increase water and check regulating valve
Low head pressure	Receiver empty	Close king valve; check float valve
	Safety valve on compressor discharge leaking	Repair
	Bypass valve partially open or leaking	Close or repair
High suction pressure	Receiver empty	Close king valve. Check float valve
	Cooling load too heavy	Check quantity and ascertain cause
	Compressor not working properly; valves sticking or leaking	Examine and repair
	Expansion valve open too wide	Close
Low suction pressure	King valve closed	Open
	Float valve stuck, closed	Use bypass
	Too much ice on coils	Shut down compressor until ice melts off
	Solenoid valve on liquid line stuck	Check and repair
	Expansion valve not open wide enough	Open more
Compressor knocking, discharge line cold	Liquid coming over	Throttle suction valve and ascertain cause
Compressor knocking	Loose flywheel	Tighten bolts
	Loose crank pin bearings	Overhaul
	Loose wrist pins	Overhaul
	Broken piston ring	Overhaul
	Broken or stuck valve	Overhaul
	Hold-down screws on suction valve loose	Overhaul
Unable to maintain cooler temperature	Oil in cooler coils or plates	Purge
	Too much load	Investigate and correct

tubes carefully for pitting and corrosion. Tube ends, extending slightly from the tube sheet, usually in shell and tube condensers, often corrode and break off very soon after being put in service. Don't worry about this. Most serious pitting usually occurs where the tubes are rolled into the tube sheet, or just inside this point. When pitting and corrosion have reduced tube to one-half its original thickness, replace it. Leaky tubes that are in fairly good condition can usually be tightened by careful re-rolling.

Condenser water. An adequate supply is essential to the proper operation of any refrigerating plant. Most plants use auxiliary supply water regulating valves. Set them to open up when head pressure reaches 160 psi—corresponding to 88 F. This gives a fair balance between water and electricity costs. During plant shutdown at night and over the week end, if room temperature exceeds 88 F, as it may in summer, set the water-regulating valve for a higher pressure. As temperature rises, ammonia pressure in condenser and receiver increases and thus water is wasted. Take the water-regulating valve apart and clean it regularly; check its operation daily. Don't assume water supply is sufficient just because head pressure is low—the valve may be stuck, wide open.

Condenser water-cooling towers. Inspect periodically and keep in good repair. Watch closely in extremely cold weather because ice of sufficient weight to wreck the tower can build up quickly. In winter, when plant is shut down at night or over the week end, draw down water level in the tower pan.

Receiver. It holds liquid refrigerant after it comes from the condenser. Don't subject it to high temperatures. When washing floors, don't spray with hot water. During operation, keep gage-glass cocks open and check liquid level constantly; when plant is shut down keep the cocks closed. To remove liquid from the glass when shutting it off, close the top cock first, then wait a few minutes. Liquid usually starts to boil and is forced back into the receiver through the bottom cock, which should be closed when glass is empty. If the glass breaks, safety checks in the gage cocks stop flow of liquid. However, the checks may stick or fail to seat tightly because of infrequent operation.

King valve on top of receiver. It controls liquid flow to cooling coils. After starting compressor, open king valve, and adjust to keep ammonia

(*Continued on page* 158)

Check Your Turbine Oil to Make It Last Longer

With proper manufacture and care, a charge of turbine lubricant will often give several years' service. Desirable qualities and tests are here described for operators by William G Forbes, Tidewater Associated Oil Co*

▶STEAM TURBINE OILS are manufactured with a view to imparting qualities that assure long life of the oil charge. In either land or marine service, service periods of four or five years are not uncommon.

Long life is not necessarily the result of any unusual refining process but rather comes from careful choice of crude, standard solvent refining methods and filtration through fuller's earth. Not all crudes produce first-class turbine oils and even the most suitable vary in type. Because of the variety of crudes, no standard can be outlined that would guarantee that a given crude makes the best turbine oil or that a specific refining method produces the best lubricant. All turbine oils have one feature in common, that is, they are filtered through fuller's earth at the end of the refining process to improve their ability to separate quickly from water.

For the rest, each refiner has his own ideas on manufacturing turbine oils based on crude resources, available refining methods and practical experience. Whatever the refining method, fundamental manufacturing methods do not differ in principle from the refining of automobile and diesel lubricants.

Laboratory tests carried out on new turbine oils are not always a guarantee that the particular brand will perform satisfactorily in service. These tests are, however, employed for control purposes when purchasing lubricants and are of great importance in checking the oil during its service life. The following are among the more important laboratory tests for new and used turbine oils.

Viscosity, a measure of the resistance to flow, is the most important single property of lubricating oils. The viscosimeter is to the oil man what the ruler is to the carpenter.

In this country, viscosity of lubricating oils is determined by the Saybolt Universal viscosimeter, Fig. 1. The top receptacle holds a little more than enough oil to fill the 60-cu cm flask. Oil temperature is brought to 100 F for light oils and 210 F for heavier types by a surrounding bath. The time in seconds required to fill the flask to the mark is recorded as viscosity.

For example, an oil that required 500 seconds to pass the outlet at 100 F would be recorded as viscosity 500 at 100 F, SSU (Saybolt Seconds Universal). As a general rule, viscosity readings are taken at 100 F for time limits between 40 and 1000 sec. Readings below 40 sec, corresponding to heavy kerosene, are not accurate and few lubricants are found in this range.

Heavier oils are run at 210 F. For example, an oil which takes 150 sec at this temperature would be recorded as viscosity 150 at 210 F, SSU.

A very important test, particularly for used oil in a circulating system, is the check of *neutralization number*. This test gives a good idea of aging

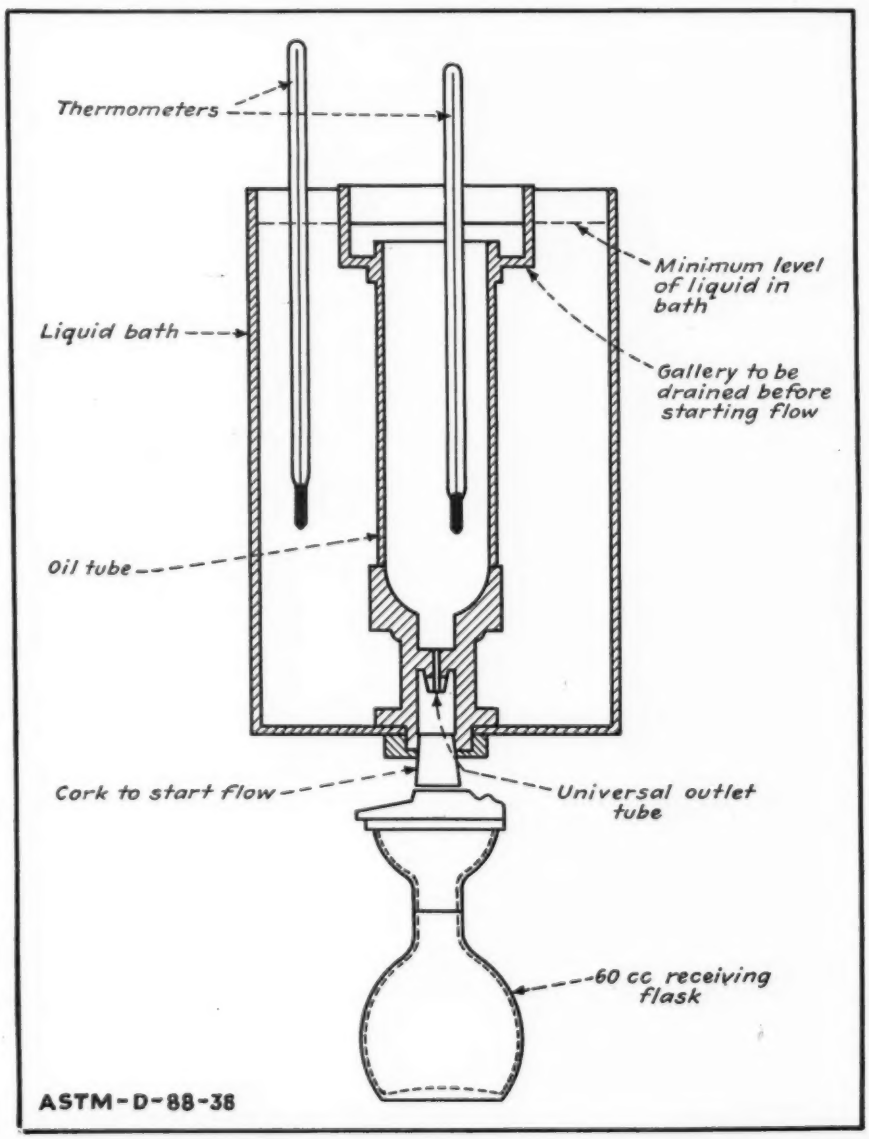


Fig. 1—Saybolt Universal viscosimeter for measuring fluidity of oils by timing flow of 60 cu cm through 0.1765-cm outlet

*Condensed from the author's forthcoming book, "Lubrication of Industrial and Marine Machinery". John Wiley & Sons. All rights reserved

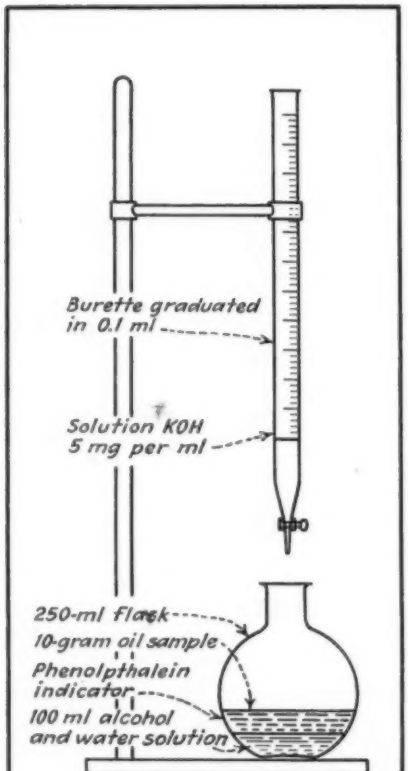


Fig. 2—Test for neutralization number calls for washing oil with alcohol to dissolve acids, then adding caustic in the presence of phenolphthalein indicator

and oxidation that is occurring or has occurred during service life.

The neutralization number is the weight in milligrams of caustic potash required to neutralize the acid content of one gram of oil. The common abbreviation is written "mg KOH." Most newly refined straight mineral oils register a slight petroleum acid content; only the lightest grades of highly refined oils show zero. The fatty acid content, however, forms and increases as the oil oxidizes and ages in service. Neutralization number increase, then, gives a clue to the possible breakdown point where accelerated sludging of an oil charge should be anticipated.

The neutralization number of new oil is generally considered of little importance because beneficial additives increase the original acidity. The majority of compounds added to reduce oxidation are themselves reactive to an alkali. However, all lubricating oils should be entirely free from any acid used in the refining process. As a general rule, straight mineral turbine, gear and machine oils are limited to a maximum neutralization number of 0.10. Compounded gear oils and the like run higher depending on the compound used.

After a period of 50 operating hours, the average neutralization number for used motor oils ranges from 1.0 to 5. Turbine oils, on the other hand, often run 30,000–40,000 hours without exceeding a neutralization number of 0.10.

The presence of excess petroleum acid, or similar product of oxidation, can generally be detected by the odor of used oil. Instead of the familiar rather pleasant odor of new oil, the vapor is pungent and the oil color dark. The odor test, however, can be used as a guide only on samples known to be free from gasoline or similar contaminants that smother the delicate sense of smell.

Water Separation

Steam emulsion number of new oil is an important indication of its ability to separate readily from water. The test consists of passing steam at 212 F through 20 cubic centimeters of oil in a specified test tube for a period of from four to six minutes. The tube is then placed in a bath at 200 F and the time taken by the oil to separate from condensed steam is clocked in seconds, which is recorded as the steam emulsion number.

The emulsion test is sensitive. Once an oil has been circulated through a turbine system, the number rises. Zero or instantaneous separation would be ideal for a new oil but actual light oils separate in 15–25 seconds, medium oils in 30–50 seconds and heavy-medium oils in 40–80 seconds.

Another measure of the ability of oils to separate from water is furnished by the *demulsibility* test. Under prescribed mixing conditions in a container with a paddle, 27 cc of oil and 53 cc of distilled water are agitated. Temperature is held at 130 F for light oils and 180 F for heavier grades.

On completion of the mixing process, the oil and water commence to separate. A demulsibility of 1620 means that all 27 cc have separated from the water in 60 seconds or less, that is, 27 cc x 60 sec = 1620. Only light-bodied oils will give this desirable result. The guaranteed figure on new turbine oil is generally 26 x 60 = 1560 indicating that only 26 cc of the oil charge separated in 60 seconds.

High demulsibility results from filtering oil through fine grades of clay of which fuller's earth is an example. Filtering lightens the color, removes some of the carbon-forming material and imparts good demulsibility properties to straight mineral oils.

Turning from the characteristics of lubricating oil to the effect of surrounding conditions on its useful life, we note that the effect of temperature on oil is generally underestimated. In circulating systems, the life on an oil

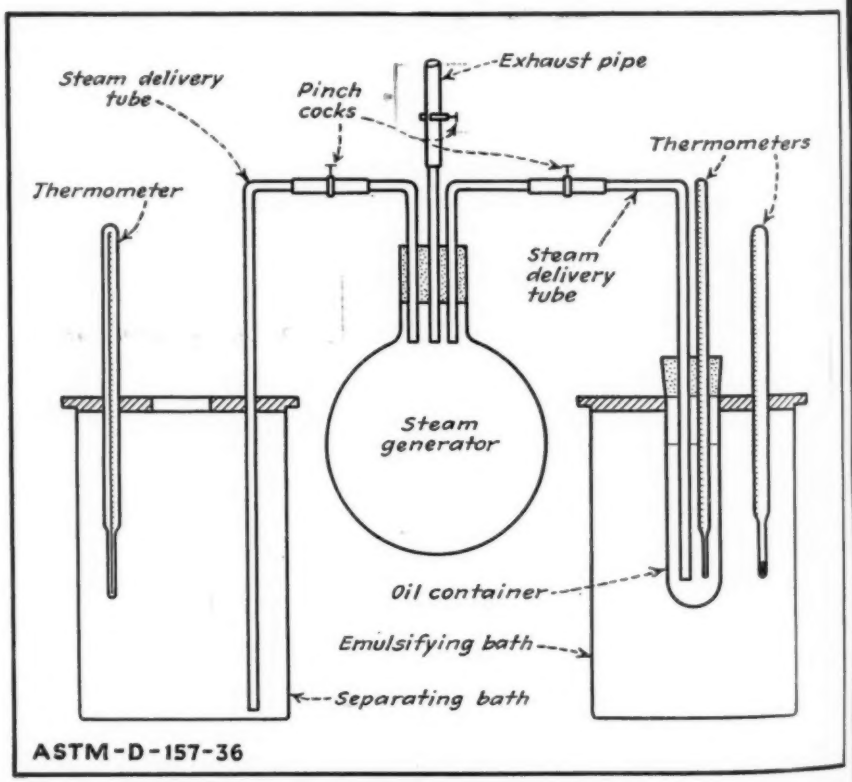


Fig. 3—Steam emulsion test requires bubbling steam through oil sample, then counting seconds until separation is complete in 200-F bath

is just about cut in half for every 15-F rise above 140 F. This relationship between the oxidation process and temperature is fundamental with petroleum products and the estimate is based on average operating conditions. Practical experience coincides closely with theory on this subject.

For High Temperatures

On the other hand, heavy-bodied cylinder stocks having a viscosity of about 300 seconds at 210 F may be circulated at 400 to 500 F for appreciable periods of time. Such oils are not employed in turbine circulating systems but usually are employed as heat transfer agents. Under anything like the same conditions a turbine oil would vaporize and be destroyed in a matter of hours.

For operating temperatures between 140 and 180 F there is a wide choice of lubricants depending on speed, load, type of equipment and so on, but 180 F may be taken as a critical temperature. At higher temperatures, oxidation and sludging reach a point where the oil must be changed frequently regardless of measures taken to keep it clean and free from oxidation products during service.

Some metals affect the life of turbine oils. Iron and steel are practically inert to straight minerals and fatty oils so that containers, pipes and tanks are best made of ferrous material. Of the metals that have an undesirable catalytic effect on oils, zinc, lead, brass and copper rank first in the order named. Lead seldom enters the construction of containers or lubricating systems but alloys of zinc and copper have been proved by experiment to have a detrimental effect on turbine oils.

As a result of these findings, turbine designers now employ steel tanks and piping for circulating oil systems. Copper-alloy-oil-cooler tubes, used because of their high rate of heat transfer, seem not to affect the oil seriously since they quickly take on a thin coating of oxidized oil which protects the oil from direct contact with the metal.

Turbine oils are refined to impart maximum stability by extracting unsaturated hydrocarbons from the original crude. These unsaturated hydrocarbons may be likened to starving molecules created without their full share of hydrogen. They are quite ready to satisfy their appetites on other digestible atoms. Air offers a convenient and ready source of oxygen. When unsaturated hydrocarbons react with oxygen, however, a new stable compound is formed, the familiar lube-oil sludge.

Laboratory analysis of a typical sludge taken from a turbine oiling system shows this composition:

Material	*Percent*
Oxidized oil	8.0
Water	22.0
Oil	69.5
Ash	0.5

Analysis of the ash shows 0.2% iron oxide, 0.12% copper and 0.18% unidentified organic material. Most of the materials in the ash were in the form of metallic soaps before their reduction by heat.

Heat accelerates the rate of oxidation; the higher the operating temperature of oil, the more rapidly sludge forms. Sludge composition can be most complex as a result of unsaturated hydrocarbons combining with elements other than oxygen.

Sludge is an active emulsifying agent and most emulsions contain oxidized oil and water. In isolated cases, however, an emulsion is formed by a foreign substance such as linseed-oil paint or cleaning compounds.

All this discussion of oil characteristics, testing and sludge formation leads up to the operator's problem of determining the proper time for oil change in a circulating turbine-oil system. The most popular and widely used method of judging the rate of breakdown is the neutralization number test. The fatty acids developed during oxidation are an invariable forerunner of sludge. The neutralization number test is by no means infallible, but is at least a good guide to the limit of useful life of an oil charge. For example, a sudden rise in acidity and viscosity usually indicates that

(*Continued on page* 156)

Typical Test Results for Three Grades of New Turbine Oil

Test	*Light*	*Medium*	*Heavy*
SAE number	....	20	30
Saybolt viscosity at 100 F SSU	150	300	400
Flash point, F	385	420	450
Pour point, F	30	30	30
Carbon residue, %	0.02	0.08	0.25
Demulsibility at 130 F	1620	1620	....
Demulsibility at 180 F	....	....	1620
Steam emulsion number	25	40	80
Neutralization number	0.05	0.05	0.05

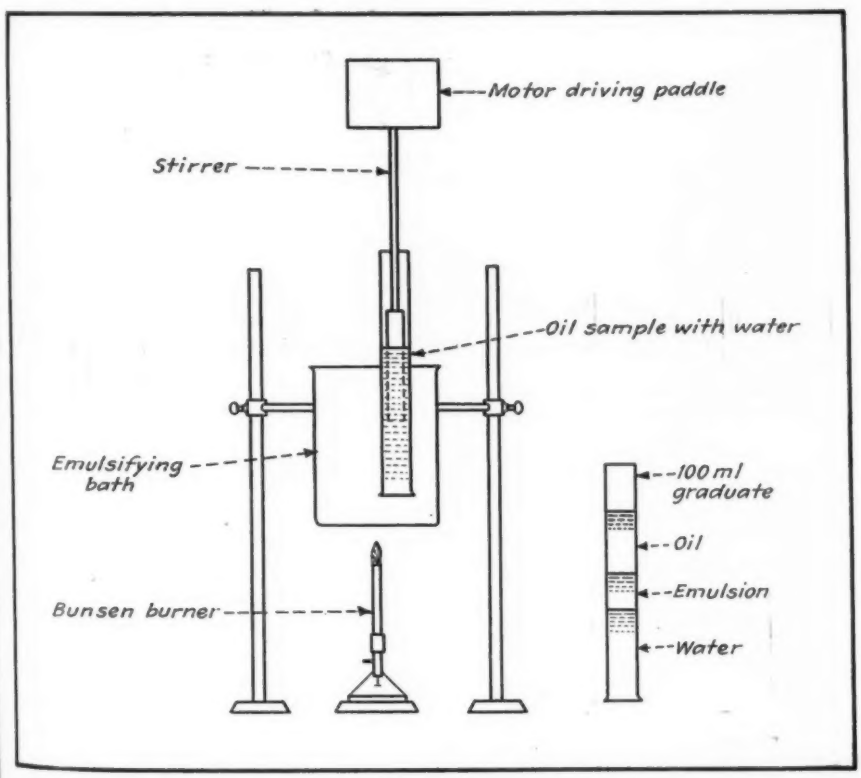


Fig. 4—Demulsibility test involves mixing measured quantities of oil and distilled water with a paddle. Number of cc that separate in 60 sec indicates demulsibility

Welding Saves Time and Money in Repair of Turbine Blade Grooves

Built-up welding's got what it takes for quicker, better repair of eroded turbine interior, *says* ***Robert N Tucker, superintendent, Division of Electricity, city of Columbus, Ohio,* comparing two units: one repaired by welding, the other by machining grooves and installing strips***

► AFTER EROSION had taken serious toll of two 3600-rpm-turbine casings, one was repaired by conventional mechanical methods with a boring bar, while the other was restored by arc welding. The following comparison of costs and results of the two operations indicates many advantages for the welding procedure.

Form of erosion in both machines was typical, Fig. 1, with the result that much of the metal of the blade-supporting ridges was irregularly cut away. Depth of cutting was not uniform circumferentially.

The supporting ridges that form grooves for low-pressure stationary blades had worn to a point where loosening of the blade sections was imminent. In one machine, A, some sections had already shifted. This increased the clearance between the tips of the moving blades and the casing wall, and because of the reduced efficiency some rows needed to be replaced.

*Condensed from prize paper on maintenance of machinery and mechanical equipment for James F Lincoln Arc Welding Foundation

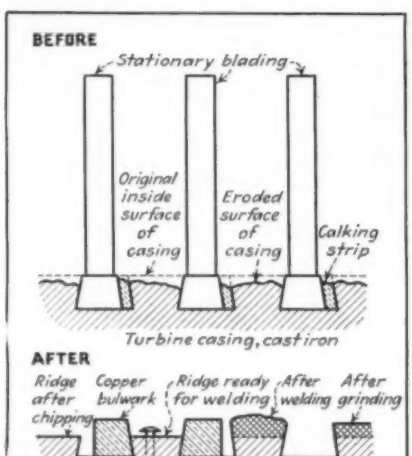


Fig. 1—Section through a portion of the casing of turbine B. Erosion between stationary blade rows threatened blade failure. Chipping roughened surface and building up ridges by welding between copper bulwarks restored dimensions

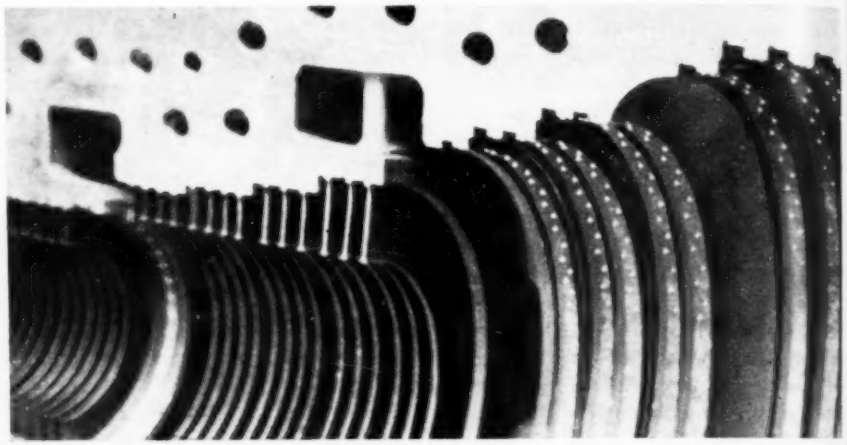


Fig. 2—Inside of turbine casing with last nine rows of blading removed, rough surfaces chipped off and ⅛-in. anchor screws (white dots) in place ready for welding

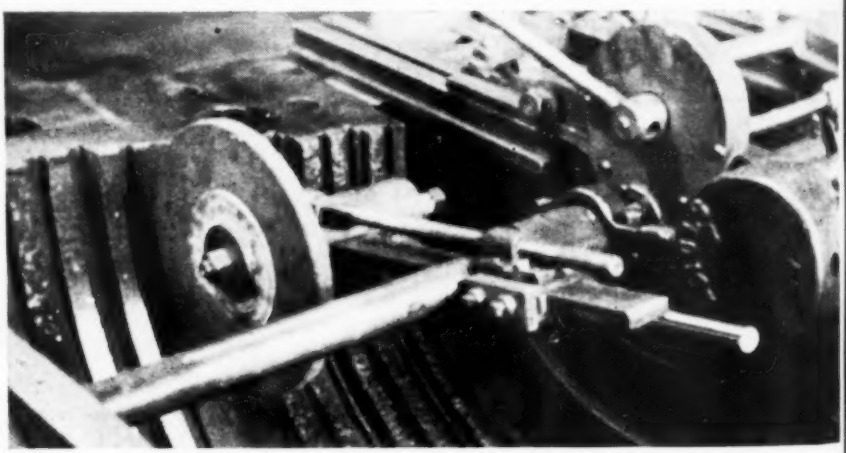


Fig. 3—Simple grinding rig centered in turbine casing finishes ridges to exact size. Movement of lever at top right causes wheel arm to swing with adjustable radius

Unit A has now been completely rebuilt by: (1) removing the existing stationary blading, (2) cutting away the eroded casing parts with a boring bar positioned on the spindle center line, and (3) installing brass liner strips of various cross-sections in the sides of the grooves to restore the sides of the grooves and the interior of the casing to original dimensions. Brass liners were secured by insertions, and countersunk machine screws were silver soldered in place. A slight amount of finishing work was necessary on the surface of the brass liners before the new stationary blades were installed.

Erosion damage to unit B, a smaller turbine, was practically identical with that to unit A, except that no blading had become loose. With the manufacturer's consent, repair by welding was undertaken.

The several steps in the welding procedure are outlined here to illustrate

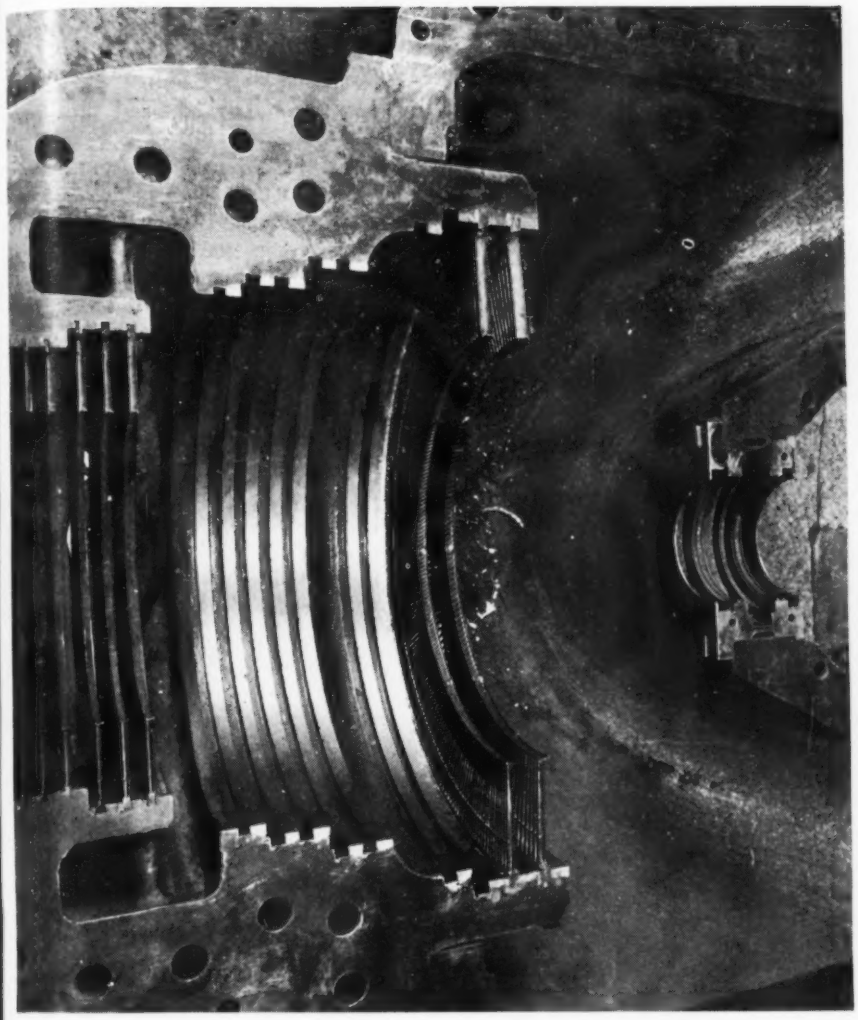


Fig. 4—Last two rows of stationary blades have been installed and seven more grooves have been rebuilt by welding and grinding. Note finished appearance of grooves

the comparative simplicity of this method of repair.

First, the calking strips were removed to loosen the stationary blading; the blades were laid aside for re-use. To yield a new metal surface for welding, an ordinary small compressed-air-operated chipping hammer and chisel trimmed off the rough portion on the ridges between the grooves.

Steel screws were driven into staggered $\frac{1}{8}$-in. holes spaced approximately $1\frac{1}{2}$-in. apart to provide additional anchorage. Fig. 2. Heavy copper bars, machined to shape, formed a bulwark on each side of the ridge during the welding operation.

Ridges were built up by electric arc welding, a $\frac{5}{32}$-in. electrode of cast-iron and nickel composition being used. Welding current varied from 300 to 350 amperes. Welding was intermittent; that is, short beads of metal not exceeding two in. of ridge length were laid at various points so as not to overheat any local area of the casing.

After all ridges had been built up by the deposit of weld metal to a point slightly above the required finish line, an adjustable grinding wheel, Fig. 3, mounted on a radial swinging arm was used to grind down surplus weld metal. Center of rotation of the grinding-wheel arm corresponded to the center of the turbine shaft.

One man operated the grinding rig. Cutting the ridges down to dimension was an exceedingly simple operation and required relatively little time and labor. The new surface presented after grinding is more resistant to corrosion than the original material because of the weld metal's nickel content.

No machine work was required before reconditioning the grooves other than cleaning with chisel point and wire brush to remove small particles. No trouble was experienced from weld metal adhering to the copper bulwark strips, which were used repeatedly.

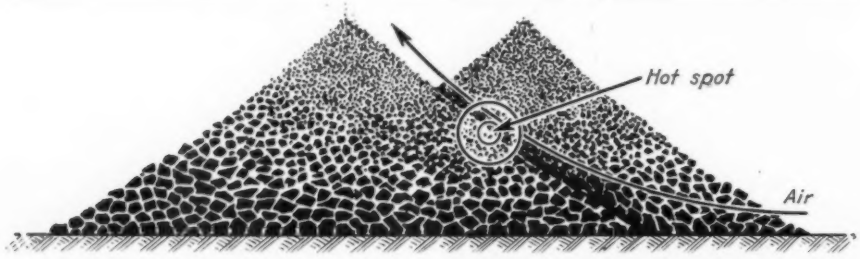
After the original blading was reinstalled, radial clearance of the moving blades was reestablished to the original minimum. In this respect the machine is now as good as new. Turbine life has been extended perhaps 10 to 15 years in so far as the casing is concerned.

Cost figures in the table below indicate much less material and labor for the welding procedure than for the machining operations. Because the unit repaired by welding has only two-thirds the capacity of the machine in which brass strips were used, all costs for mechanical repair have been arbitrarily reduced by one-third to obtain as nearly as possibly a fair comparison.

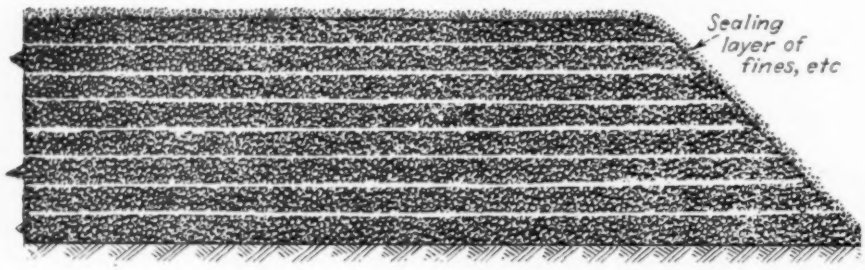
TABLE OF COMPARISON MECHANICAL AND WELDING METHODS*

Procedure	*Mechanical Repair Only*	*Welding and Mechanical Repair*
Materials	Brass liners, screws, turbine blading	Anchor screws, weld metal
Equipment	Large boring bar	Welding machine and grinder
Men	3 to 4	1 to 3
New stationary blading	All	None
Mechanic for boring bar	133 hr—$387	.....
Welder	.....	40 hr—$153
Material costs	$4310**	$118
Labor and other costs	$2420	$452
Total cost	$6730	$570
Total man hours	1030	268
Days to repair casing and install blading	42	19
Estimate of replacing turbine if no repairs were possible	$120,000	$120,000

*Turbine repaired by welding is 2/3 the size of the one repaired by mechanical method. Costs, repair time, etc. in the first column have, therefore, been arbitrarily reduced by one-third to get a fair comparison.
**Estimate $3600 of this amount for new blading.



Segregation of voids produces flues for air passage; overheating usually results



Layering avoids segregation; thin coating of fine coal on surface seals against air

Drag Scrapers Can Be Put to Good Use if—

You want to keep down coal-storage costs, use minimum skilled and unskilled labor, and gain security against long shutdowns, says H A Roe, chief engineer, Sauerman Bros, Inc

► WILL THE STORAGE PILE be fire-safe? How deep can you pile coal? How big a handling crew is needed? What about cost of handling into and out of storage?

These are some of the questions the engineer asks when considering a fuel-storage layout. This article gives the answers from the standpoint of drag-scraper equipment, just as a preceding article ("Drag Scrapers Offer Safe, Flexible Solution to Coal-Storage Problems"—POWER, May 1943 pg 66) showed how drag scrapers have been adapted to a wide variety of physical conditions and operating problems.

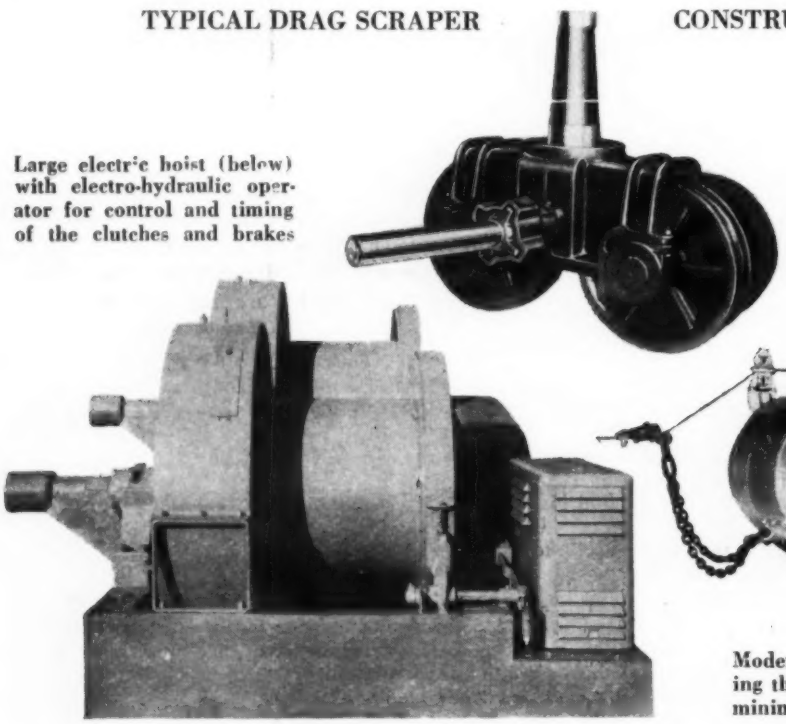
Under today's conditions, many plants store coal for the first time and most others store more coal than ever before. This focuses attention on spontaneous combustion and potential losses and hazards of coal-pile fires. The latter is no problem if the handling equipment "layers-in" the coal to avoid segregation and operates to form a fairly homogeneous pile.

In simplest terms, whether temperatures get high enough to cause a fire depends on how fast oxygen enters the pile, and is absorbed, and how fast heat leaves it and is dissipated. Air currents through the voids form the principal medium for oxygen supply. Differences between air temperature within the pile and air (wind) pressure at outside surfaces cause these currents.

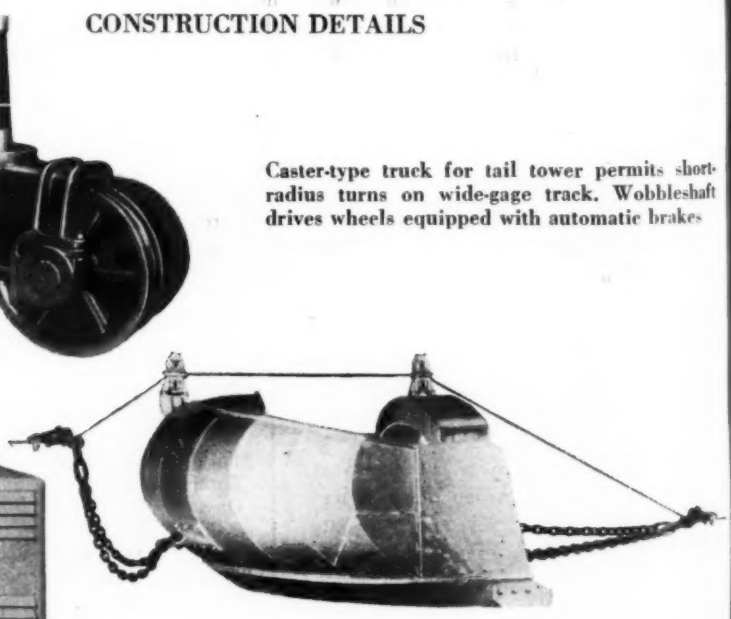
When the fuel is segregated, the

TYPICAL DRAG SCRAPER CONSTRUCTION DETAILS

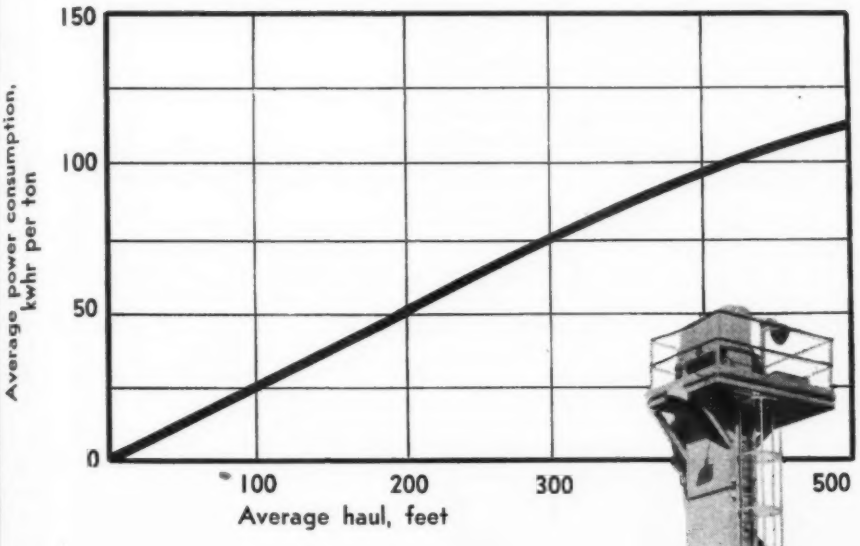
Large electric hoist (below) with electro-hydraulic operator for control and timing of the clutches and brakes



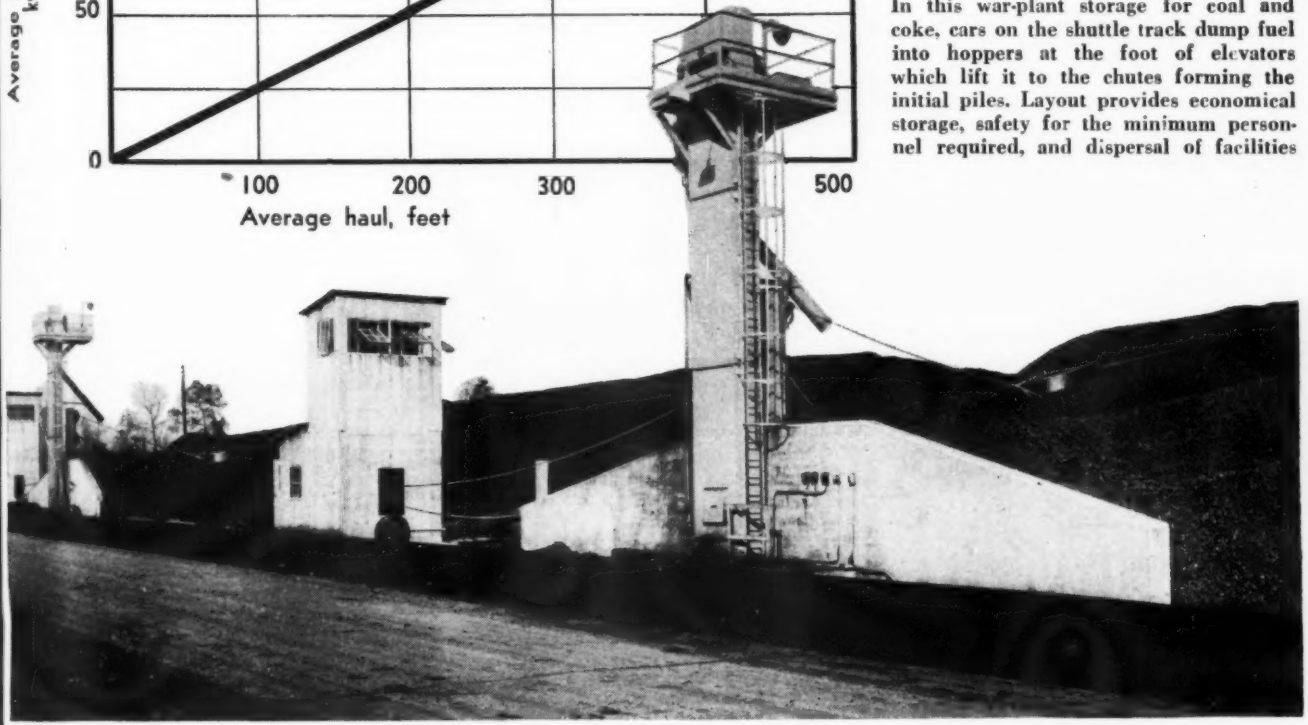
Caster-type truck for tail tower permits short-radius turns on wide-gage track. Wobbleshaft drives wheels equipped with automatic brakes



Modern design of 10-cu-yd bucket, with wedge clamps holding the continuous operating cable, insures uniform loading, minimum power consumption and easy righting if overturned



Curve at left shows the almost straight-line relationship between power consumption of drag-scraper equipment and the average distance hauled, in feet



In this war-plant storage for coal and coke, cars on the shuttle track dump fuel into hoppers at the foot of elevators which lift it to the chutes forming the initial piles. Layout provides economical storage, safety for the minimum personnel required, and dispersal of facilities

voids between fuel particles are also. This frequently forms flues which draw air along the bottom of the pile and discharge it slowly from the top. See sketch pg 74. This air supplies oxygen to the coal and the resulting oxidation, or slow burning, produces heat. If rate of ventilation is too slow, heat accumulates, temperature rises, rate of oxidation increases, and firing occurs.

Although firing might be avoided by providing enough air to remove heat as fast as it developed, under practical conditions the solution lies in reducing air flow through the pile to a minimum. Be particularly careful to avoid segregation, because a fire can start at any spot where conditions are right.

Storage in layers, as in the sketch, insures mixing of fine and coarse particles and thus prevents wide variation in air flow through the pile. A perfectly uniform pile of any ordinary steam coal does not fire from thermostatic air circulation. It may, however, require a blanket of fine coal or other protection against exterior wind pressure.

Drag-scraper equipment works essentially on a layer-piling principle, but the operator must understand the need for avoiding segregation and shift the line of operation laterally as often as possible. This is, of course, easiest on installations with mobile tail towers which are easily controlled from the operator's station. Given an understanding of safe-storage principles, you can form a coal pile that will not show dangerous initial temperature rise and will remain in storage for years without serious deterioration.

Submerged Storage

Some drag-scraper storage piles have been partially submerged to prevent coal deterioration under water, but they have not proved satisfactory. Rise and fall of the water table tends to pump air into the pile to replace water in the voids, while the partially saturated coal presents a favorable condition for chemical action.

One of the first substantial scraper-storage plants, built to serve a central station using high-volatile coal and located alongside a river, made provision for submerging the coal in three radial compartments of a concrete pit. Lowering the water table by withdrawing water from one compartment caused temperatures to go up rapidly and the coal to smoke before it could be used. In recent years, this plant has operated successfully as a dry storage.

So much for fire safety—how about depth of storage? The idea that there is some virtue in shallow storage piles—seven, ten or twelve feet deep—seems to have made a comeback recently. From the drag-scraper standpoint, these depths are not unfavorable in any way. But they are ill advised for safe and economical coal storage.

Such piles expose a high percentage of surface to atmosphere, sun and contamination, take up a lot of ground space, and increase haulage distances. They are without compensating advantages unless it is assumed that fire is probable and deterioration unavoidable, thus making "get-at-ableness" a prime consideration.

Favored storage depth for drag-scraper operation ranges from 15 to 20 ft for small- and medium-sized piles, and from 30 to 40 ft for large piles.

(*Continued on page* 160)

Maintenance Tips Keep Electronic Control

And they work longer hours without interruption when intelligent handling of maintenance, trouble-finding and trouble-correcting smooths the way. A highlight discussion based on the skill and long experience of W D Cockrell, electronic engineer of the General Electric Co

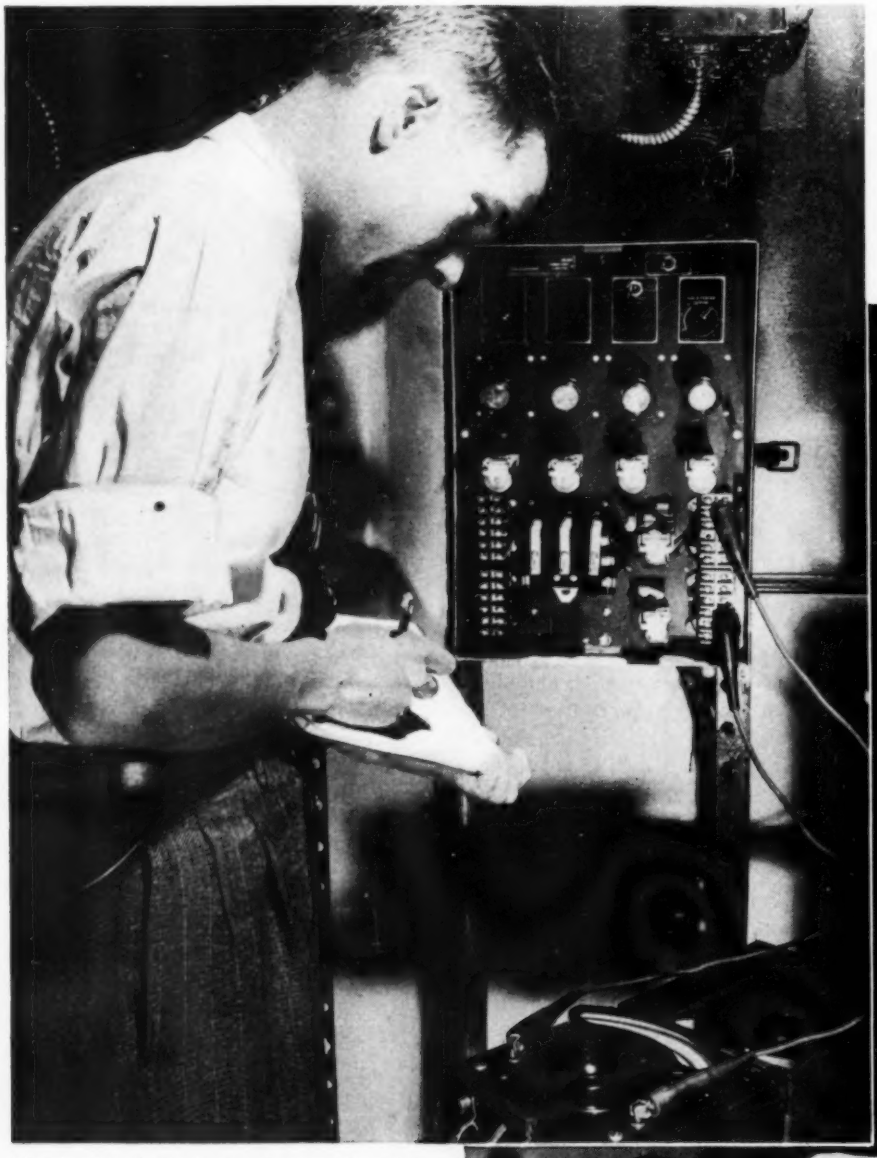


Fig. 1—Checking electronic-control equipment for line voltage which should be within 5% plus or minus, of nameplate rating to obtain good performance

Fig. 2—Checking electronic tube in tube tester. Check tubes in control apparatus regularly, replacing any defective ones

► BECAUSE ELECTRONIC EQUIPMENT has no moving or wearing parts, it generally requires less maintenance than other electric equipment. But to keep parts in topnotch condition and prevent production interruptions, it is important to observe the simple rules of good maintenance scrupulously.

Neglect often occurs because elec-

n the Job—

Fig. 3—With clean, soft rags wipe off lenses and other parts of photoelectric optical system regularly

tronic-control parts, such as resistors, reactors, transformers and capacitors, are conservatively rated to give many years of service with little upkeep. Electron tubes themselves require inspection and test for replacement only at comparatively long intervals. To these reasons for neglect, add the fact that electronic control sometimes continues to function under extreme conditions of moisture, temperature and dirt for long periods.

Remember that many electronic-control parts are similar to those in magnetic controls. Enclosing cases, bases, terminals, wiring and conduit devices are frequently identical. Standard magnetic control devices, such as fuses, switches and overload relays of both instantaneous and time-delay types, are found on many electronic panels. These devices usually perform starting or protective functions and such infrequent operations sometimes result in special maintenance problems, as on standard magnetic-control panels. Manuals covering these standard devices have detailed inspection and maintenance instructions.

Preventive Maintenance

Cleanliness Because of high impedances in some electronic circuits, an excessive accumulation of dust or processed material, particularly when damp, provides parasite circuits which may interfere with proper operation. Wipe off lenses and other parts of optical systems frequently with a clean, soft rag, Fig. 3.

Effects of Vibration Since many electronic panels are interconnected with other apparatus, loosening of connections or breakage of leads because of vibration may cause expensive shutdowns involving intensive trouble-shooting to locate the difficulty. Vibration also tends to shorten tube life. Severe vibration at installation location may justify shock-mounting control panels as well as use of stranded or extra-flexible leads.

Adjustments Disturbed Check frequently photoelectric and other electronic controls that have mechanical parts, to assure that their adjustments have not been disturbed. Bolts loosened by vibration are a common cause of disturbance and so is the hitting of chain hoists or other shop equipment against mechanical parts, Fig. 4.

Avoid Shocks

Shocks and Jars in Handling They can be detrimental, particularly when tubes are old. Sharp shocks from accidents, such as dropping or striking the tube, may jar the elements out of position or even break welds on leads.

Tube Failure Gradual Very rarely does a modern electronic tube fail suddenly. Usually failure results from gradual loss of emission that takes place as the active cathode material is used up or flakes off. Overloading, mechanical abuse, operation at high or low cathode heater voltage, and operation outside required temperature limits—all tend to shorten tube life.

Line Voltages Among the most prevalent causes of poor operation and short tube life are operation of electronic panels on line voltages differing too greatly from the panel nameplate voltage, and use of the wrong tap when a tapped input transformer is provided. Panels are usually designed to operate satisfactorily on line voltages varying plus or minus 5% of panel rating. If voltage at installation point is consistently high or low, use a small auto- or booster-transformer. Line voltage that fluctuates widely may require a special voltage-regulating transformer. Faulty heater transformers, loose connections and corroded socket connections also may limit the low-voltage high-current power required for the cathode heater.

Ambient Temperature

Ambient Temperature High-vacuum tubes and those filled with true gases, such as argon and xenon, may operate without difficulty over a wide ambient-temperature range, but tubes using mercury vapor operate best in a more restricted ambient range. Enclosing-case ventilation and other temperature-regulating means are provided for the usual industrial indoor ambient temperatures of 60 to 100 F. For low

ambient temperatures, manually or thermostatically controlled strip heaters may be mounted in the case. For temperatures from 100 to 120 F, fan or forced-air cooling may be sufficient. Temperatures above 120 F may affect components other than the tubes and standard equipment may prove unsuitable for the installation.

Cathode-Protector Timer Panels that use gas- or mercury-filled tubes are normally equipped with a cathode-protector timer, which should be set for the heating period given in the instructions accompanying each tube. Experience has proved this time to be the minimum for reasonable tube life—not to be decreased for any reason.

Mercury-vapor Tubes During shipment or handling, liquid mercury may splash on the elements. Therefore, when the tube is first placed in service, heat its cathode for a time with the anode lead disconnected, distilling off the splashed mercury before applying the anode power. Tube instructions give the proper time, which is longer than the usual cathode-heating time.

When in service, mercury-vapor tubes should stand upright as much as possible to keep the mercury from getting on the elements.

Overloading Tubes Some electronic panels are designed to use tubes on external loads. Do not permit these loads to be greater than either average or peak rating of tubes. Sometimes operators increase the anode voltage, replace coils, or alter motor pulleys or gearing to obtain a greater output, thus overloading the tubes. Avoid such practices because they seriously reduce tube life.

Trouble-Shooting

Best trouble-shooting tool is a clear knowledge of the operation of the panel and each of its parts. If there is partial operation but other actions fail to occur, try to isolate the trouble to a part of the circuit.

Since many circuits on electronic panels have a very high impedance, meters with high impedances are desirable in servicing the equipment. A radio-service multimeter that has a resistance of 1000 ohms per volt or higher is a useful tool. For some circuits, however, an electronic meter, such as a vacuum-tube voltmeter with dc reading or a cathode-ray oscilloscope, is essential. The latter, particularly when modified to read dc potentials, is an extremely useful device. It combines a high-impedance voltmeter with a time axis, thus making visible-voltage changes much too rapid for the ordinary meter to follow. Instantaneous thyratron-grid and plate potentials and other voltage waveforms may be observed easily on the oscilloscope and incorrect operation quickly detected.

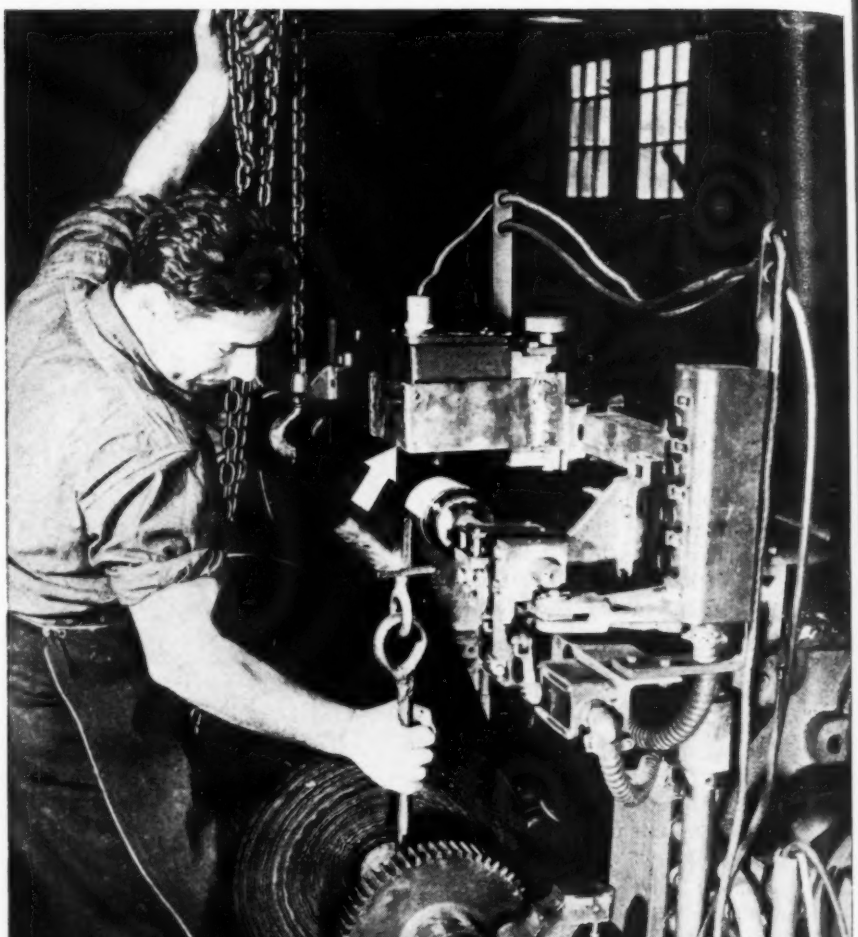


Fig. 4—Protect photoelectric scanning head and similar parts. Arrow points to guard installed around scanning head to prevent the chain hoist or its load striking it

Make sure that trouble is in the electronic equipment by asking yourself these five questions:

1. Is power available at the control-panel terminals?
2. If alternate means, such as from a dc bus by drum switch or magnetic control, are provided, can I operate motor or other device by them?
3. Do all protective devices and interlocks outside the panel operate properly?
4. Has the cathode protective-timer relay completed its timing cycle and applied anode power?
5. Have mechanical adjustments been disturbed when scanning heads or other mechanical components are used?

Roughly, failure occurs at three times: (1) when starting new equipment, (2) when starting after a shutdown, and (3) during operation:

When New Equipment Fails to Start Cause may be lack of correct power, incorrect or missing connections, tubes in wrong sockets, wrong or defective tubes, no fuses or wrong-sized fuses, or damage to panel leads or parts during shipment.

Check incoming power voltage and frequency against panel nameplate. The remedy for no power, missing wires and fuses is obvious: Refer to the wiring and panel stamping to check position and type of tubes. Defective tubes and, sometimes, tubes in the wrong sockets, may not heat up. In glass tubes, glow of the hot cathode may usually be seen; in metal tubes, the envelope becomes hot to the touch. The envelope of metal thyratrons and ignitrons is at cathode potential, so *do not touch while power is on the panel.*

When Equipment Does Not Operate After Shutdown In case of failure after a normal shutdown, first check power, interlocks and safety switches. The cathode-heating timer relay may have failed or the anode contactor may be defective. An old tube often fails because of expansion or contraction as

(*Continued on page* 166)

Recognize Air-Compressor Troubles by Their Early Symptoms

Prevent long outages and wasteful service interruptions? Yes, you actually can by repairing machine defects before they get serious. In these answers to questions H H Miller, Worthington Pump & Machinery Corp, calls attention to warning signals that point to trouble

▶AIR-COMPRESSOR OUTAGES can cripple production even more than absent workmen because an interrupted air supply holds up entire departments. Accordingly, it is vitally important to find and repair compressor and vacuum pump troubles before a machine reaches the breakdown stage. Here are 14 practical answers to questions that tell how to detect the cause of such troubles and guard against extensive damage from them.

Q 1—Does a change from normal intercooler pressure indicate trouble within the machine?

A—In multi-stage compressors, intercooler pressure when operating at normal full load should equal the theoretical calculated pressure. If there is no explanation for pressure rise, it indicates leaky or broken valves in the h-p cylinder. If pressure falls, look for leaky valves in the 1-p cylinder. Unloading may change normal intercooler pressure.

In standard 2-stage motor-driven machines, most compressors today have unloading devices that operate simultaneously on all cylinders, thus maintaining fairly constant intercooler pressure. Process compressors, operating with either a variable suction or discharge pressure, have a fluctuating intercooler pressure. You can use hand-operated clearance pockets on either or both cylinders of such machines, to adjust within a reasonable amount an otherwise varying intercooler pressure resulting from variable intake or discharge pressures.

Finding A Leaking Valve

Q 2—When intercooler pressure indicates a leaky or broken compressor valve, how do you tell which one is defective without removing all valves?

A—Experienced operators usually identify the offending valve by cover temperature that is somewhat greater than the others, or by a slight difference in the valve-operating sound, or by both of these symptoms.

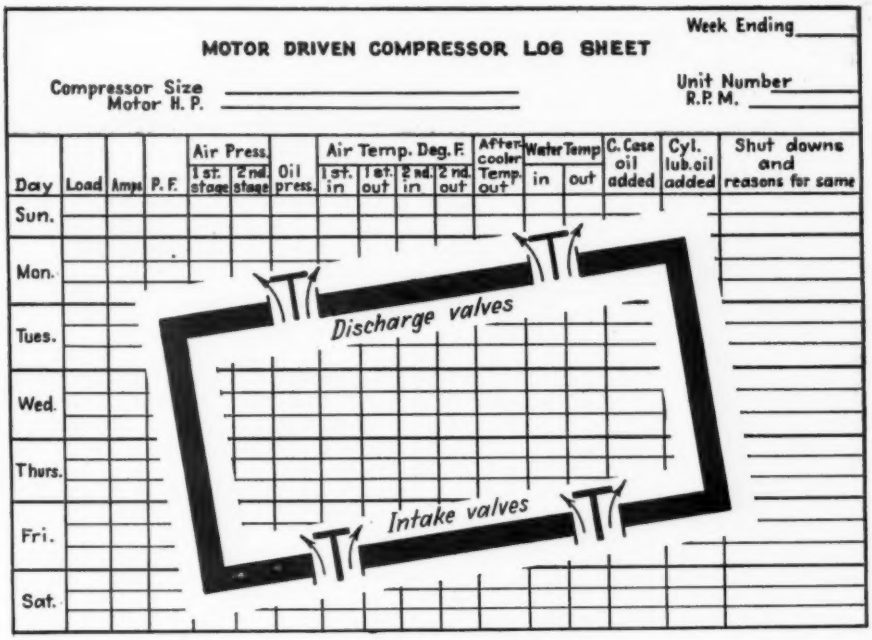


Fig. 1—Keep an operating record of compressor performance. When making up a sheet for steam units use a column for rpm as air-temperature varies with the speed Fig. 2 (inset)—Use care when inserting valve assemblies. Discharge valves must open away from the compressor cylinder and inlet valves must open toward the cylinder

Q 3—How may the discharge temperature indicate the compressor's mechanical condition?

A—A compressor, operating under the same air pressure and cooling-water temperature, should register constant discharge-air temperature. If the latter increases while the other conditions remain constant, leakage is definitely indicated—usually of the hot discharge back to an intermediate pressure. It may be either valve or piston-ring leakage. In multi-stage compressors, a power-plant log record of interstage pressures and temperatures should be regular practice, because it definitely notifies the operator when to examine piston rings and valves. An increase in discharge temperature also puts him on guard concerning the mechanical condition of a single-stage unit.

Q 4—What causes discharge air temperature to increase gradually and the cylinder to become somewhat hotter than formerly, when piston rings and valves are in first-class condition and jacket-water temperature is normal?

A—After years of operation, if jacket-water quality is not particularly good, the jacket cooling effect may have deteriorated considerably. When you use lake or river water that contains sufficient silt or mud to precipitate in the jackets and restrict free circulation, or when the water is very hard, the inside surface of jacket walls may be covered with heavy lime or magnesium deposit, which interferes with normal heat transfer. The answer, of course, is to clean the jackets thoroughly. In the case of lime deposits, soaking the jackets while hot with caustic or weak muriatic acid may make it possible to scrape out the deposit.

Q 5—How do you locate the cause of a loud knock in the cylinder?

A—If you can isolate the noise to one end of the cylinder where it does

not register back to the crankpin, it may be that the jam screws are not holding a valve case tightly and as a result allow the entire case to pound on its seat. A valve cage that is allowed to hammer will break, with the possibility of disastrous results if a piece falls into the cylinder and is hit by the piston.

If the valve cages are tight, piston may be loose on the rod, or the piston may be hitting the head, either because clearance between them has not been properly adjusted at the two ends or because clearance space may be filled with a carbon deposit or condensate. Usually, such a pound can be heard at the crankpin, fooling the operator into thinking that the main bearing or crankpin is loose.

Q 6—What causes cylinder wall to appear dry with a slightly rusty appearance, some 15 minutes after cylinder head is removed?

A—Cause is lack of lubrication or possibly washing of lubricant from the walls. If a normal amount of lubricant is fed, check the cylinder's circulating water temperature. If cooling water is much colder than entering air or gas, sufficient moisture may be precipitated on cylinder wall to wash off lubricant. Or, incomplete separation of condensate at the high-pressure cylinder inlet may cause the trouble. The intercooler, of course, has reduced air or gas temperature to the dewpoint so that air is saturated at the high-pressure intake. Any liquid passing to the high-pressure cylinder wears the suction valves seriously and causes rapid cylinder-wall wear by washing off the lubricant. In other cases, sufficient mist carried by the air into the high-pressure cylinder affects lubrication.

Q 7—What causes rapid wear of valves and cylinder walls of a vacuum pump?

A—In practically all cases wear comes from carrying liquid condensate over to the cylinder, or handling an acid condition of vapors, or more frequently from a combination of both. A vacuum pump handling reasonably dry air seldom gives trouble. Oftener, the pump handles hot wet air or gas vapors containing a trace of acid, which may cause considerable trouble, especially rapid wear of valves, piston rings, cylinder walls and pistons. Wet vapors contain considerable moisture, some of which deposits in the suction line and is too often allowed to carry over into the pump. More vapor is condensed by cold jacket water on pump walls and as a result considerable water passes through the machine and out through the discharge. In itself this causes rapid wear of working parts even though condensate is not corrosive. Wear is accelerated when you add a corrosive agent to the condensate. Moreover, slight corrosion not evident to the naked eye may weaken valve plates.

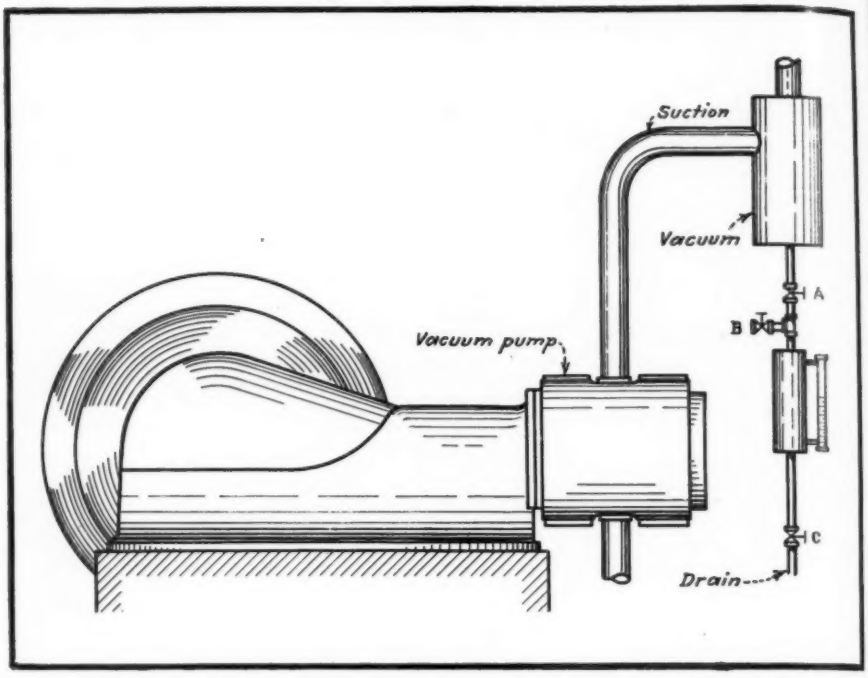


Fig. 3—Separator protects vacuum pump against carryover. To drain, close valve *A* and open *B* and *C*. Return to service by closing the valves *B* and *C*, and opening *A*

Suction Piping Design

The suction piping for vacuum pumps handling vapors should be carefully designed and the most effective separators possible used near the pump. Slope suction line toward pump and never have a low spot where collected liquid may carry over into the machine in a slug, as this frequently wrecks the pump. A mere water leg on the suction line next to the pump, while collecting most of the condensate is not entirely effective. The separator should take the form of a fairly large receiver to provide for the dropping out of suspended moisture. Directing the entering air to impinge against metal surfaces or baffles makes more effective separation.

Do not attempt to make a condenser out of a vacuum pump. Install a regular condenser on hot condensible vapor lines to remove a maximum of condensibles and to cool the intake gas.

Jacket circulating-water temperature should not be appreciably below that of intake vapors. Do not choke down amount of jacket water to raise discharge water temperature but heat the water by a small steam jet or heat exchanger and use a reasonable quantity to get good jacket circulation and velocity. If cooling-water temperature varies widely, it may be desirable to regulate the jacket-water temperature by a thermostatic valve.

A slightly compounded oil is usually beneficial for lubricating such vacuum pumps, as the resulting film is not readily washed off the surfaces.

Q 8—What causes liquid to seep out of stuffing boxes past the packing, when wet hydrocarbon gases are compressed, especially when the inlet gas temperature is above 100 F?

A—Wet and hot hydrocarbon gases frequently condense within the cylinder when cold jacket water is used because the cylinder is in effect a condenser. Of course, the condensate, which is perhaps some form of gasoline, cuts the lubricant and rapidly ruins cylinder walls, piston rings, valves and packing. The answer in all such cases is to heat up the entering jacket water to the temperature of the entering gas.

Q 9—Why should aftercoolers be used with compressors?

A—The air that is compressed contains considerable moisture, varying with atmospheric conditions. As compression takes place, rising temperature greatly increases the air's moisture-carrying capacity; discharge air at 100 psi and 300 F can carry many times the moisture in air at atmospheric conditions. As the compressed air cools to approximately atmospheric temperature, this moisture deposits in pipelines and, aside from being objectionable in the line, is destructive to pneumatic

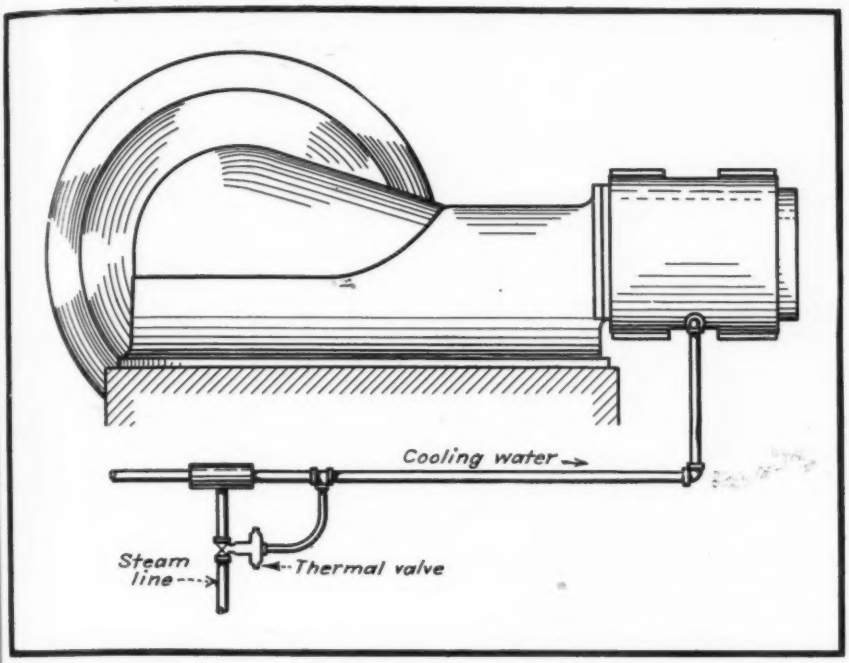


Fig. 4—Inlet water considerably colder than incoming air causes cylinder condensation. Use a thermal valve to raise water temperature 10 F above the inlet air or gas

tools or other air-operated mechanical equipment. Besides, there is a great loss in man-hours and power, from operators blowing down air lines each time before they use air.

Installing an aftercooler as an accessory to the compressor reduces the compressed air temperature immediately, so that the moisture precipitates in aftercooler and receiver, for removal by automatic traps or valves, before compressed air enters the system.

Q 10—Where should the aftercooler be located?

A—Plant conditions vary, but usually the best place is directly at the compressor discharge, as near the compressor as conditions permit. Placing the aftercooler between compressor and receiver allows condensate, not removed by the aftercooler trap, to precipitate out in the air receiver. Locate the aftercooler indoors to prevent freezing, but the air receiver can be placed outdoors.

A bypass around the aftercooler permits dismantling for cleaning or repair without shutting down the compressor. In all such cases you must, of course, install a relief valve on the compressor side of the bypass to avoid damage from improper valve operation.

Q 11—Does an aftercooler eliminate moisture difficulties in all cases?

A—Reduction in air temperature and, therefore, its moisture-carrying capacity, is limited by the cooling-water temperature. If the air cannot be cooled to a very low temperature in the aftercooler, but subsequently cools to lower temperature by atmospheric radiation in the system, more water will precipitate. However, most of the water is removed at the aftercooler, and later condensation may be trapped out by plac-

(*Continued on page* 140)

Kentucky School for Power Men

Fig. 1—Seventy men from Ashland's industries learn the how and the why of pumps and steam machinery from George Coughlin, superintendent of the four Armco steam plants in this Kentucky City on the Ohio. Already the results can be seen in the local plants

Editor Phil Swain tells how George Coughlin, steam-plant chief, is solving his manpower problem, training new men and old to better maintenance, better operation and better understanding of the job — with some sidelights on the pleasures of Kentucky hospitality.

▶ THIS IS A vest-pocket travelogue—my diary of a couple of days in Ashland, Kentucky, where a visiting editor can combine the business of self-education with the pleasures of Southern hospitality. The tip came "over the transom," as we say in the editorial office. George Coughlin, superintendent of steam power for Ashland Armco (Ashland Division of the American Rolling Mill Company) was writing to me on another matter. What caught my eye was his incidental mention of a sizable steam engineering school he was running for men in Armco and other Ashland plants.

For months POWER's editors had been considering the likelihood that the steady loss of trained men to the armed services would eventually force power engineers into this school-teaching business. Here was a chance to see a hardshell school in action and tell its story for the benefit of other engineers

Fig. 3—Mr Coughlin shows how the water valves work on a duplex pump. Note boiler and pulverizing models used in other lectures

Fig. 2—New 1250-ton-per-day Bellefonte blast furnace will do a better war job because Armco's men are going to school learning about pumps, boilers, engines and turbines

who would soon be faced with the same manpower problems.

In response to my wire, Mr Coughlin (later known as George) gave me the green light. It was cool, misty and 5 a.m. when I hopped off the George Washington express and taxied to the Henry Clay Hotel. In that morning fog Ashland seemed just another steel town. A few hours later, I rediscovered it as a beautiful little city, green, clean and well tended—a good place to live—in short, a minor miracle as steel towns go.

Seeking an explanation, I was given three reasons: the progressive personnel and civic policies of Armco and other local manufacturing companies, the use of clean natural-gas fuel in open hearths and rolling mills, the "all American" population of town and mills.

A further word about this population may interest you, as it did me. The surrounding hill country of West Virginia, Kentucky and Tennessee is one of the most truly American sections of our land. Everywhere you meet the descendants of the early settlers—Scotch, English and Irish. They told me that better than 99% of the Ashland Armco employees are of this early American stock and I sensed this as I wandered around the mills and talked with operating and maintenance men of all grades.

Blast Furnace Deluxe

As a former combustion engineer, now chief of Ashland Armco's four steam plants, George Coughlin is a busy man, yet he gave me his whole day and evening, and another day to boot. First, he drove me to his airy office in the newest steam plant serving the big new Bellefonte blast furnace. Working under Mr Coughlin, the engineer in charge here is Thomas H Rhodes, who can well be proud of this fine plant—modern equipment—laid out with lots of air and working space—whole place kept spic and span.

Fired by cleaned, dust-free blast-furnace gas, the four boilers generate 350,000 lb of steam per hour at 220 psi and 600 F. The steam powers a big 75,000-cfm turbo-blower supplying blast furnace air at 30 psi.

This plant also pumps a lot of water—some for boiler feed, but far more for blast-furnace cooling. In all, Tom Rhodes is responsible for about 19 turbine-driven pumps and one motor-driven unit. The big pump floor, plus an imposing array of tanks, filters and softeners, reminded me again that every blast furnace is also pretty much of a water works.

Automatic controls in the boiler house keep steam pressure and gas-air ratio in line and balance the draft. Special controls on the turbo-blower deliver a constant weight of air to the furnace, regardless of variations in furnace pressure, air temperature and barometric pressure.

The Bellefonte blast furnace itself, finished in August, 1942, along with this steam plant to serve it, is a fine modern job with a daily capacity of 1250 tons. In line with the latest practice, all blast air is chemically dried to insure the maximum blast-furnace capacity regardless of weather.

The blast-furnace gas is cleaned first by washing, then by electrostatic precipitating. This refinement kills trouble all along the line—no dust to clog gas lines, valves, stoves and boiler furnaces.

Luncheon Party

Pleasant surprise of the day was a luncheon given by George Coughlin in the hospitable dining room of the Henry Clay, where he got together a representative group of people connected with the management of his school. Associate Professor James May (heating and ventilating) and Associate Professor R E Shaver (surveying) had driven 130 miles from the University of Kentucky at Lexington. They explained that the power-plant course was college-grade instruction, under the government's "ESMWT" (engineering science, management, war training program), sponsored in this region by the University of Kentucky. The regional administrator is D V Terrell, Assistant Dean of Engineering, University of Kentucky. Professor May is Assistant administrator and coordinator, and Professor Shaver is travel representative.

Others present were Dr Herschel Heath, of the Ashland Junior College, official coordinator of vocational training in Ashland; William A Jordan, training supervisor for Ashland Armco; Leo F Brislin of Armco's Training department; A S Chamberlain, personnel manager for Ashland Oil and Refining Co and his assistant, Earl W Weaver; R A Whealy, supervisor of plant training at the Refinery; E B Conklin, superintendent of Semet Solvay, Ashland. All of these men were interested be-

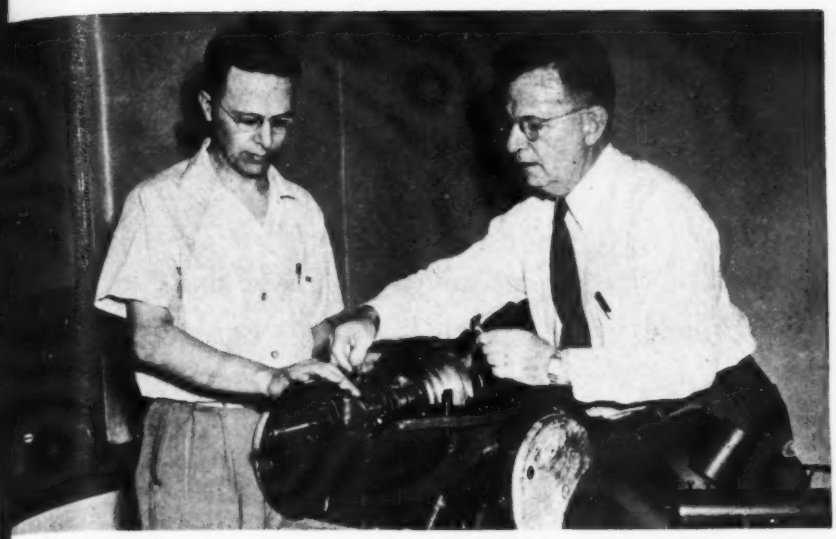
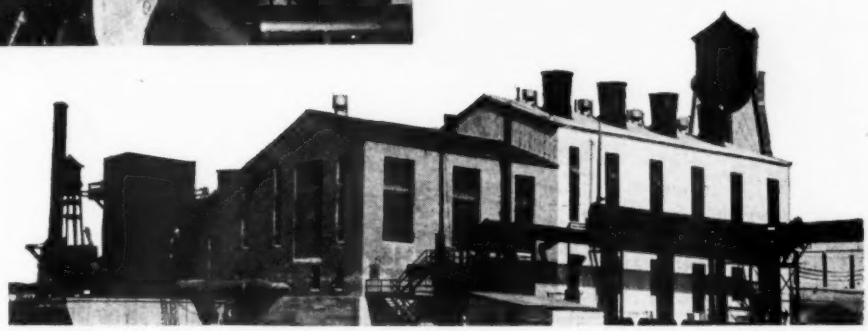


Fig. 4—Tom Rhodes, left, power engineer of the Bellefonte-furnace steam plant, knows more than a bit about pumps himself, but listens respectfully while his boss, George Coughlin, makes a practical point about the packing

Fig. 5—All this to serve the Bellefonte furnace: left to right—tower for predrying the furnace blast; engine room housing the 75,000-cfm turbine-driven blast-furnace blower with 20 pumps for furnace cooling and boiler feed; boiler room with a capacity of 350,000 lb per hr



ause the study course served men in ll local plants, not merely the Armco lants. It was a pleasant lunch and utually profitable.

Norton and Sixth Street

In the afternoon George showed me wo other Armco plants: Norton Blast urnace and Sixth Street Blast Furace. Norton, one of the older plants, ave me a closeup of typical steel-mill aintenance. The blast furnace, which as down for relining, presented one f the rare opportunities for complete verhaul of the steam equipment. This team layout (boilers, pumps, blowing ngines, etc) had to be ready to start n the dot, without fail, when the furace was ready to blow in. At Norton urnace I met Wm Richmond, general oreman of the Furnace and "Cy" Kramer, George Coughlin's general oreman for the steam department.

Next, we drove over to Sixth Street urnace, another old timer, but in opration. Here we looked over a row of ix outdoor boilers fired with raw blasturnace gas, also some big vertical lowing engines. What appeared to be our engines turned out to be two. By hat I mean that the high-pressure and ow-pressure parts of each engine were eally separate machines with no mehanical connection. Each had its own rankshaft and its own pair of 20-ft ywheels.

One thing that puzzled me was the nncanny ability of the operator, Lee Campbell, to keep the h-p and l-p ranks running 90 degrees apart (as lose as I could tell by eye) with no echanical connection between them. ee, by the way, is one of George oughlin's students.

All this was background for the ain objective of this trip—visit to e actual class held on Monday night in the Armco schoolhouse at Eleventh and Greenup Streets. About 45 men packed every available seat in the little schoolroom.

But first a word about the schedule: The course, as laid out by Mr Coughlin under the sponsorship of the ESMWT, was planned to start in February and run for 16 consecutive weeks with two-hour sessions, finishing June 8. Then the classes would stop to avoid the summer heat and humidity. Classes on other subjects may be started later.

Subject Outline

The outline called for 10 hours on the fundamentals of heat, 6 hours on fuels and combustion, 6 hours on boilers and draft equipment, 8 hours on steam engines, turbines, pumps and lubrication, and 2 "miscellaneous."

To avoid shift conflicts the men enrolled were divided into two groups, one meeting Friday night and the other repeating on the following Monday night. Total enrollment ran about 90, of which about 70 might be described as active students. About 50 came from Armco, 15 from the Refinery and 7 from Semet Solvay.

The class I visited made plenty of progress with the subject matter, despite flashing interruptions by Frank Elam, plant photographer, who was busy taking the photographs for this article. The subject was "pumps." Backed by a blackboard and flanked by a small duplex steam pump on one side and a dismantled centrifugal on the other, teacher Coughlin drilled his students in the inner workings of these machines.

Pump Talk

In simple language he explained the valve mechanism and operation of the duplex pump, showed how to trim packing to fit, how to set up (not "sweat up") the glands. For the centrifugal pump he demonstrated the functions of the impeller, scroll casing, packing glands, lantern rings, seal rings, etc. He explained suction lift—told what lift was and was not reasonable at this altitude, showed how to avoid air pockets, how to keep shaft sleeves from scoring from muddy water.

All in all, it was clear that George knew his stuff and could make it understandable to the men in the one-armed chairs. His presentation sank home because Armco, the Refinery and Semet Solvay were full of pumps. Here was training for the daily job—training that increased plant efficiency, reduced breakdowns, helped the plants carry on despite wartime manpower losses. And, as for the men, they invested time and thereby earned dividends of greater skill, and satisfaction and a better chance of promotion.

After class I asked a few of the Kentuckians what the course had done for

(*Continued on page* 142)

Diesels Show High Economy Using Low-Gravity Fuels

Workmanlike design and ability to operate units at high load factor enable Southeastern Indiana Power Co's Rushville diesel-electric plant to generate 14.3 kwhr per gal of fuel

by GLENN C BOYER, *Associate Engineer*
Burns & McDonnell Engineering Co

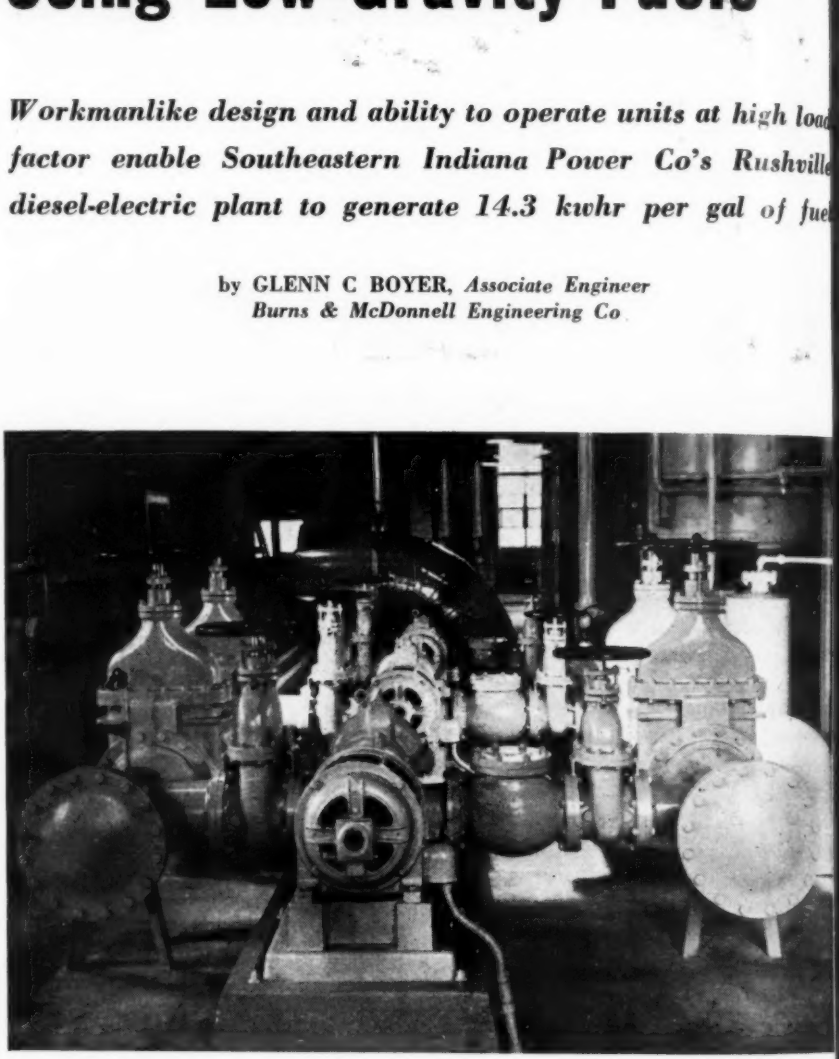
► DURING ITS FIRST FIVE MONTHS of operation, Southeastern Indiana Power Co's 6480-kw diesel-electric generating plant at Rushville, Indiana, averaged 14.3 kwhr per gal of fuel oil consumed, while power for plant auxiliaries amounted to 1.4% of gross generation.

This performance results from careful design and the ability to operate at relatively high load factor, ranging from 65 to 70%. Outstanding elements of the design include: (1) engines specified to burn low-gravity high-viscosity fuels with mechanical-injection equipment. (2) maximum heat recovery from exhaust, (3) minimum use of electrical energy for auxiliary operation, (4) ample storage and handling facilities for fuel and lubricating oil, and (5) careful planning of electrical facilities.

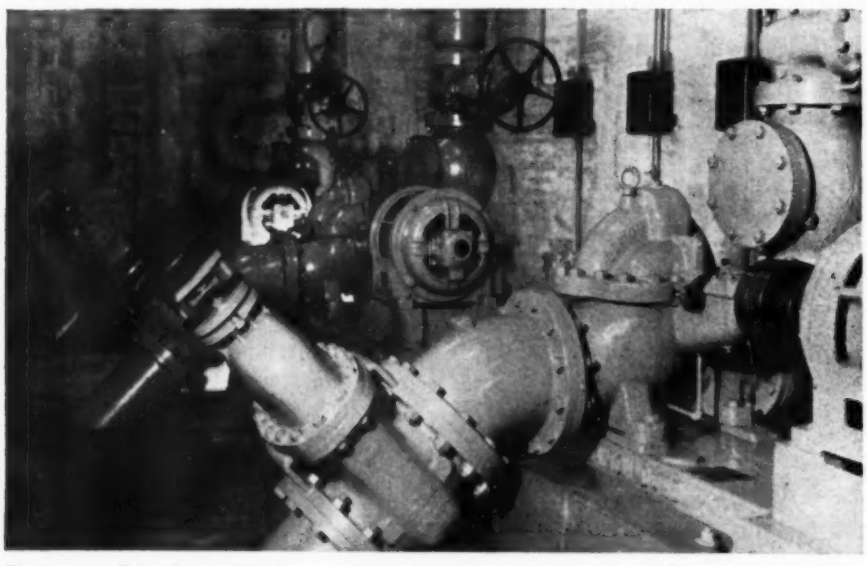
Plant Equipment

As now constructed, the plant contains three units, each consisting of a 3060-hp engine and 2160-kw alternator. Four units were originally ordered and foundations, switchgear and station auxiliaries were provided for a 4-unit plant. However, during the construction period the War Production Board found it necessary to divert one of the units on order. Contract for the diesel generating units and all accessory equipment went to the Busch-Sulzer Bros Diesel Engine Co, in March 1941; wartime difficulties delayed completion of the plant until October 1942.

The engines are 9-cyl 2-cycle 20.5x 27.5-in. 240-rpm trunk-piston units which have mechanical-injection equipment designed to handle low-gravity high-viscosity fuel. Electric Machinery Mfg Co built the generators, which are rated at 2700 kva, 4160v, and have



Trimness characterizes layout of jacket-water pumps and headers in auxiliary room



Raw water flows by gravity from an old mill race to the suction of these three 1650-gpm units in the pump pit located at the east end of the auxiliary room

V-belted exciters. An individual voltage regulator serves each generator.

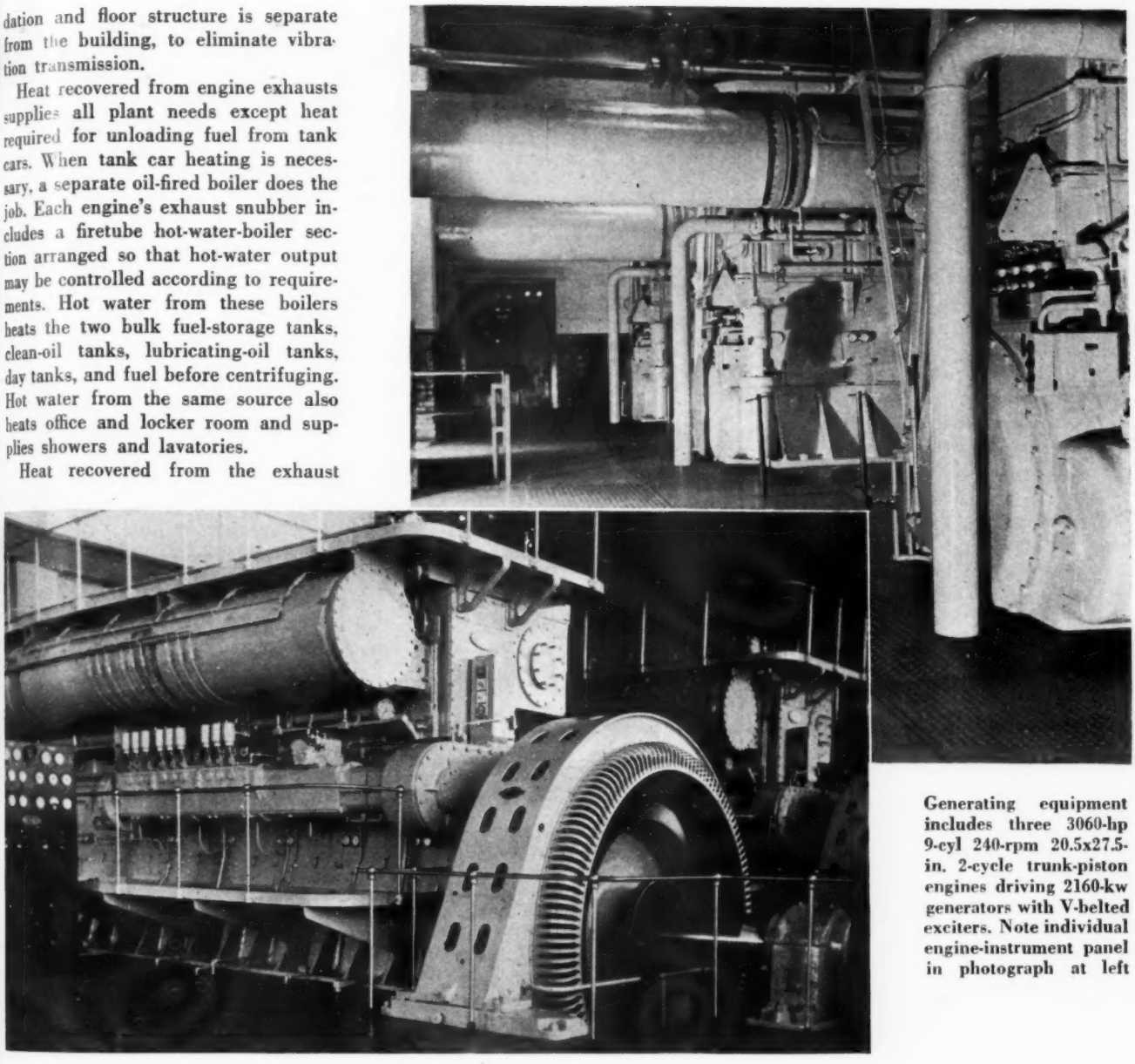
What was formerly a steam-power station for an interurban traction line now houses the diesel units. Of reinforced-concrete, brick and steel construction, this existing structure was 125x111 ft, with a full basement and operating floor level about 6 ft above grade. Examination of the structural condition of the building and soil tests showed that it would be suitable for an electric generating plant using diesels as prime movers. The building was accordingly reconditioned and modified.

A common reinforced-concrete mat supports the four engine foundation blocks. Floor slabs between the engines at the operating floor level are integral with the foundations. The entire foun-

dation and floor structure is separate from the building, to eliminate vibration transmission.

Heat recovered from engine exhausts supplies all plant needs except heat required for unloading fuel from tank cars. When tank car heating is necessary, a separate oil-fired boiler does the job. Each engine's exhaust snubber includes a firetube hot-water-boiler section arranged so that hot-water output may be controlled according to requirements. Hot water from these boilers heats the two bulk fuel-storage tanks, clean-oil tanks, lubricating-oil tanks, day tanks, and fuel before centrifuging. Hot water from the same source also heats office and locker room and supplies showers and lavatories.

Heat recovered from the exhaust also warms the building. Air circulates around the upper part of each exhaust snubber through jackets constructed around the snubber body. Connecting ductwork from the single forced-draft fan is arranged so that the air to be heated can be circulated around any or all of the snubbers. With this arrangement, heating air need only be circulated around those snubbers connected to operating engines. Louvers in the outlet ductwork direct heated air into the engine room and into the auxiliary room housing the snubbers, or divide this air between the two rooms in accordance with their heating needs. In summer, air circulating through the snubber jackets exhausts above the building roof to aid in cooling the interior.



Generating equipment includes three 3060-hp 9-cyl 240-rpm 20.5x27.5-in. 2-cycle trunk-piston engines driving 2160-kw generators with V-belted exciters. Note individual engine-instrument panel in photograph at left

Cooling equipment for each engine consists of two tubular heat exchangers, one for lube oil and the other for jacket water. Two 1400-gpm pumps supply the present jacket requirements, with a third held in reserve. These pumps discharge into a common header; at each engine a connection branches off to the heat exchanger and then to the engine jackets. From the jackets, water discharges into a suction header to which the three pumps connect. All jacket water is softened and comes from a common supply. An expansion tank connected to the suction header absorbs variations in water volume resulting from temperature changes.

Raw Water for Cooling

Raw water for cooling comes from a mill race fed by the Flat Rock River and owned by the company. Intake and discharge tunnels connected this race to the old steam plant. Constructing the new engine foundations meant wrecking a considerable portion of the discharge tunnel inside the building. However, all of the intake and discharge tunnel outside the building was used in constructing the raw-water cooling system.

A pump pit at the east end of the auxiliary room permits gravity flow from mill race to raw-water-pump suction. Each of the three pumps is rated at 1650 gpm; only two are needed under maximum load conditions. An extra connection in the pump pit provides for a fourth raw-water pump, if needed in the future.

A comprehensive fuel-heating system insures that the heavy oil used will remain fluid during severe winter weather. The bulk storage consists of two 12,500-bbl tanks, which take oil directly from tank cars. Oil from these tanks

is heated, then, after centrifuging, it passes to a buried 10,000-gal clean-oil storage tank. Pumps transfer the oil, maintained at 140 F, to the day tanks whence it flows by gravity to the engines. A separate 15,000-gal tank stores the light fuel used for starting and stopping the engines. Meters compensated for temperature variation measure fuel transferred from clean-oil tanks to day tanks.

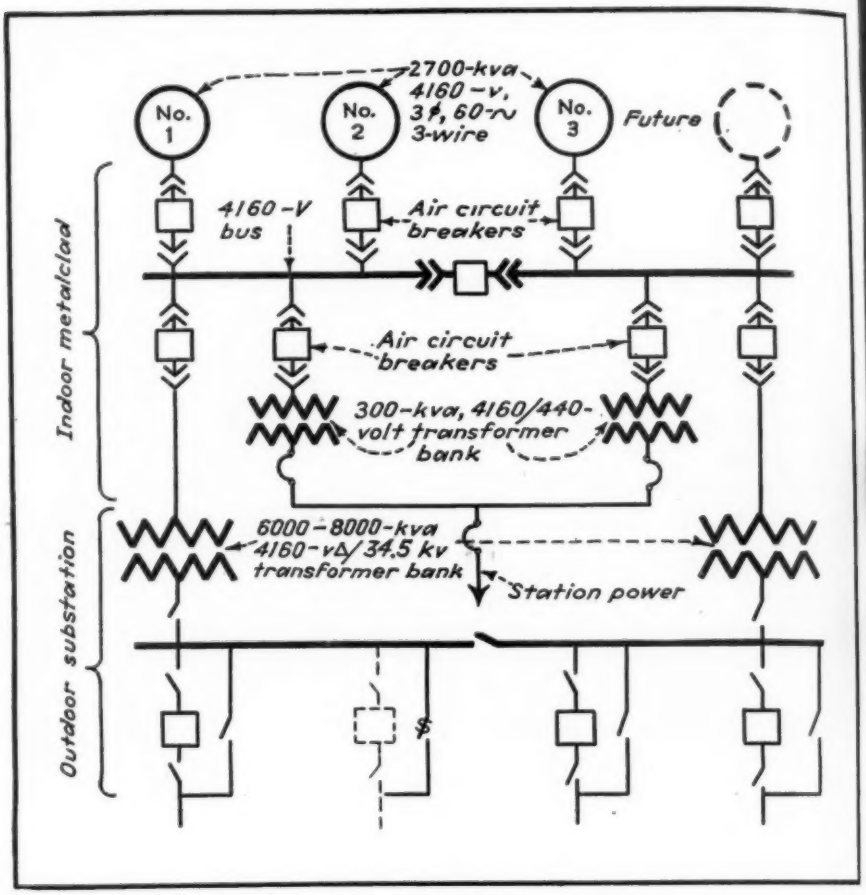
A 2-compartment 15,000-gal underground tank stores lubricating oil, which is bought in tank-car lots. One compartment holds cylinder oil, the other bearing oil. Individual motor-driven transfer pumps handle oil directly from the compartments to the engines. Calibrated level gages on the engine tanks measure the lubricating-oil consumption. A 120-gal Youngstown-Miller reclaimer purifies either bearing or cylinder oil as required.

Continuous automatic air filters in sheet-steel housings stand in the auxiliary room; air comes to the filters from a point above the auxiliary-room roof.

On the operating floor, adjacent to each engine operating platform, an individual cubicle carries instruments and alarms for each engine. The operator can see the instruments either from the operating floor or from the engine control center. Controls for motor-driven auxiliaries mount on a common control cubicle together with instruments for general plant operation.

The 4160-v generators feed into transformers in an outdoor substation which step up the voltage to 34,500 for delivery to the distribution system. Indoor switchgear consists of an 11-panel cubicle-type control board and nine metalclad air circuit breaker units. Two control panels take care of station metering and substation-breaker con-

(*Continued on page* 144)



Schematic shows how sectionalizing insures continuity of service at all times

Principal Power Equipment

Southeastern Indiana Power Co, Rushville, Ind.

Generating Equipment:

Engines, 3.....Busch-Sulzer Bros Diesel Engine Co
3060-hp 9-cyl 20.5x27.5-in. 240-rpm 2-cycle trunk-piston units, with mechanical-injection systems designed to handle low-gravity high-viscosity fuel oil

Crankshafts.....Erie Forge Co
Engine lubricating pumps.....Schutte & Koerting Co
Governors.....Woodward Governor Co
Indicator, indicator valves.....Bacharach Industrial Instrument Co
Starting-air compressors.....Gardner-Denver Co
Generators and exciters.....Electric Machinery Mfg Co
2700-kva 2160-kw 4160-v units with V-belted exciters

Intake, Exhaust and Waste-Heat-Recovery System:

Air filters, automatic, continuous.....American Air Filter Co
Snubbers, waste-heat boilers.....Burgess Battery Co
Steam-heating boiler.....Kewanee Boiler Corp
Oil burner for steam-heating boiler.....Ray Oil Burner Co
Hot-air heating system fan.....B F Sturtevant Co
Control for fan motor.....Cutler-Hammer, Inc
Dampers for hot-air heating system.....Powers Regulator Co
Hot-water pumps.....Micro-Westco Div, Pomona Pump Co

Cooling System:

Jacket-water heat exchangers.....Ross Heater & Mfg Co
Raw- and jacket-water pumps.....Dayton-Dowd Co
Water softener and sand filter.....Permutit Co
Water meter.....Worthington-Gamon Co

Lubricating System:

Oil coolers.....Ross Heater & Mfg Co
Lubricating-oil reclaimer.....Youngstown-Miller Co
Transfer pumps.....Yale & Towne Mfg Co
Gearhead motors for transfer pumps.....Master Electric Co
Oil storage tanks.....Graver Tank & Mfg Co Inc

Fuel-Oil System:

Fuel-oil centrifuges.....Sharples Corp
Fuel-oil filters.....Purolator Products Inc
Fuel-oil meters, strainers and air releases.....S F Bowser & Co Inc
Fuel-oil heaters.....Ross Heater & Mfg Co
Thermostats for fuel-heating control.....Powers Regulator Co
Main fuel-tank level gages.....Viking Pump Co
Other tank level gages.....Liquidometer Corp
Underground pipe.....Ric-wil Co

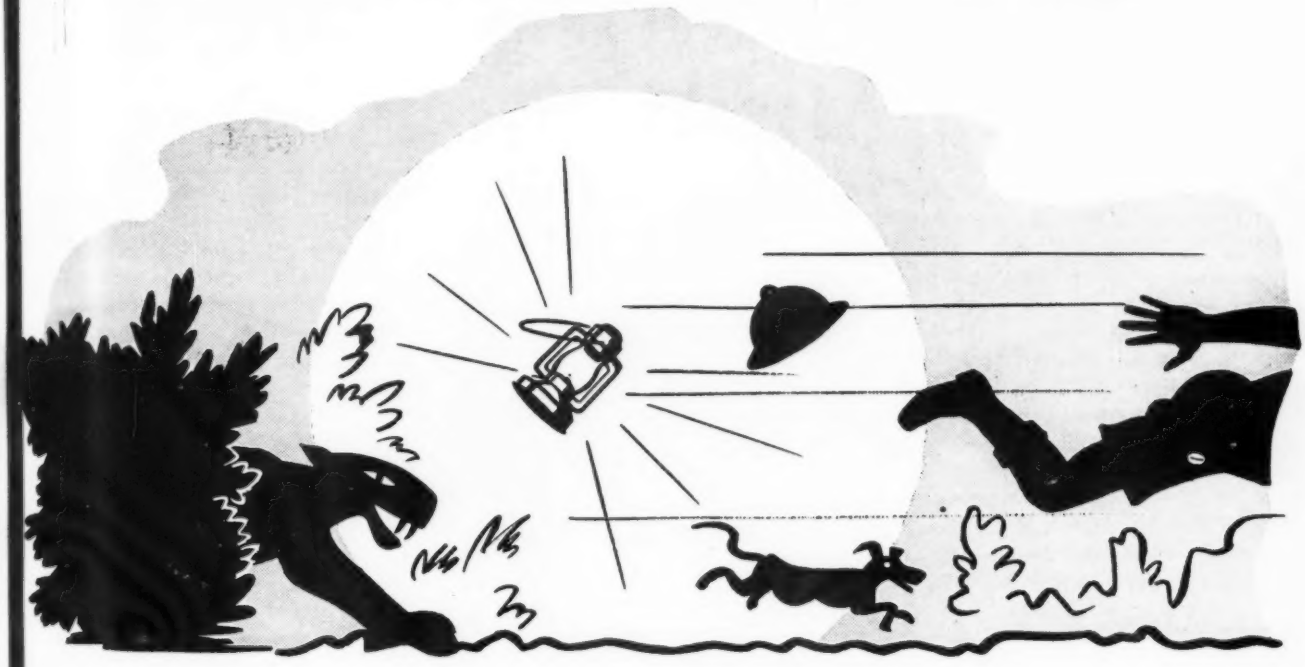
Electrical Equipment:

Switchgear and switchboard.....Westinghouse Elec & Mfg Co
Transformers and substation.....Westinghouse Elec & Mfg Co
Power cables.....Kerite Insulated Wire & Cable Co
Station control cables.....General Cable Corp
Lighting fixtures.....Holophane Co
Station dc batteries.....Philco Corp
Rectox battery charger.....Westinghouse Elec & Mfg Co
Auxiliary bus (Flex-a-Power duct).....Trumbull Electric Co
Auxiliary motors and controls.....General Electric Co

Instruments, Controls, and Miscellaneous:

Magnetic valves.....Alco Valve Co
Float switches.....Mercoid Corp
Pyrometers and thermocouples.....Illinois Testing Labs, Inc
Pressure gages and thermometers.....Jas P Marsh Corp
Hoist.....Shepard Niles Crane & Hoist Corp

Before the Lantern Hit the Ground—



An American engineer hit the homeward trail in Far Eastern hills where nabobs have a yen for English houseboats and leopards for stray dog, according to N L Rea, General Electric Co

▶ONCE UPON A TIME a nabob of the East visited England and was royally entertained because of his wealth and rank. A weekend spent on a houseboat so impressed him that the yen for houseboats for himself and his closest friends became an obsession.

That his largest river was far too small for houseboats was no obstacle to a man of means with an active mind. What to do? Why, 'twas simple! Make the river bigger. He had heard that America made hydraulic dredges and that the latest models were electrically operated.

"Have my agents buy the latest model of electric hydraulic dredge from the best American firm."

"But, your Highness, you have no electricity to operate an electric hydraulic dredge."

"Then order whatever is necessary to supply electricity to the dredge. We can light the houseboats, the royal palace and the streets with electricity."

Along with the equipment, the services of erecting engineers to supervise the work were requisitioned. The engineers selected a waterpower site and parts were transported into the hills. Months passed and somehow, some way, with toil and sweat and patience unlimited, a dam, pipeline and power house were built; waterwheel generators, transformers, transmission line, etc were constructed. Haste was the watchword. At last the project was completed and electric lights twinkled on the urgently needed houseboats.

His Royal Highness made frequent inspection in full dress—long-tailed black cutaway, light-colored pin-stripe trousers, patent leather shoes, spats and a white, starched shirt. The shirt tails, starched and ironed like boards, and worn outside the trousers, reached nearly to the knees. What was the sense of having all that white linen inside the trousers where it didn't show?" No sense at all!

White shirt tails worn outside

Evening Ritual

Breaking in the station operators proved more of a job than building the plant. The American engineers, who were quartered in a bungalow on the hill crest several hundred yards above the power house, took turns going down just before bedtime to make sure the power-house operator didn't get to sleep ahead of them. Starting down the path with a lantern, escorted by a pariah dog that had adopted the Americans, was an evening ritual.

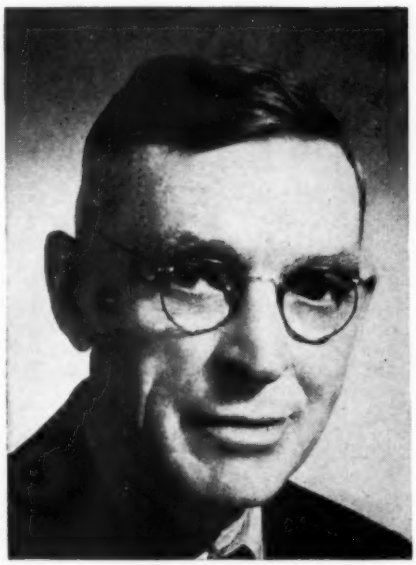
One of the Americans reported, "One night I was about a hundred yards from our bungalow when the pup nearly upset me by bolting between my legs up the path.

"I held the lantern over my head to see what had frightened the pup. There in the edge of the ring of light was a large leopard with a yen for dog. What did I do? I left the lantern hanging in the air and hit the bungalow porch ahead of the dog—before the lantern hit the ground."

An Appreciation of Industry's First Combustion Engineer

Joseph Hays

By PHIL T SPRAGUE
President, The Hays Corporation



The late Joseph Weller Hays

▶ JOSEPH WELLER HAYS, inventor, educator, lecturer, writer, newspaper editor and publisher, combustion engineer and consultant, died on April 22, 1943 at Grinnell, Iowa, at the age of 75. First child of parents who pushed west to frontier Iowa, he was a pioneer in many fields.

Born in Chester township, Poweshiek county, Iowa, November 12, 1868, he was struck with cerebro-spinal meningitis before he was two years old. He learned to walk when he saw a boy his own age walking, and his father assured him he could, too, if he tried hard enough.

Jos Hays attended a country school, Grinnell College Academy and Cornell College, Mt. Vernon, Iowa, where he was graduated with a literary degree in 1890. He went at once to Algona, Iowa, where for two eventful years he was the Algona *Republican's* entire staff—publisher, editor, writer of everything except advertisements.

Goes to Chicago

In 1893, he sold his Iowa paper and went to the great World's Columbian Exposition in Chicago. Taking his highest elevator flight to the 13th floor of the Unity Building, he looked out at the Masonic Temple, the world's highest office building, which towered 22 stories through fog and smoke.

While Mr. Hays was reporting the effect on real estate values of such developments as the electrified elevated line's "loop," in downtown Chicago, and electric transportation to the suburbs, Edith Jordan was a student at Northwestern University in nearby Evanston, Ill. Mr Hays had met her at Cornell College. They were married in 1895.

Waste and harm from smoke made such an impression on the young real estate editor that at the turn of the century he organized the sale of "The Provident Smokeless Furnace." Before this, he had sold home study courses for American School of Correspondence, and had organized the Chattel Mortgage Reporter. Disposing of this business and vowing to write a correspondence course some day that a fireman could understand, he started cleaning up in the Midwest with the Provident.

He was curious to learn more about combustion. All he could find at the Chicago Public Library was an old book by Clerk Maxwell, a Scotch engineer, that did not help in the problem of burning smoky coal smokelessly. He spent six weeks examining more than 1600 patents at the Library but found nothing worth copying. A furnace that he designed and patented in 1905 proved as smokeless as the Provident and more efficient. He sold the Canadian patent for $4000.

Next, our student of smoke wrote "Combustion and Smokeless Furnaces," which he sent to Fred R Low, editor of POWER. The Hill Publishing Co, now McGraw-Hill Pub Co, published the book. Few people seemed interested in it. His next book, "How to Get More Power from Coal," had a better sale.

As a result of writing more and more magazine articles, he visited industrial plants and made betterment suggestions. At last he had found his field: he was consulting engineer, before long consulting combustion engineer. For more than 30 years, the services of Jos W Hays, combustion engineer, were in demand with hundreds of companies from coast to coast. The cumbersome laboratory-type gas analyzer, with which he first traced down air leaks, was made portable and more convenient. It started him in the instrument business, the basement of his Chicago home being the first factory.

Growth of the Hays Instrument business led to organizing Illinois Carb-Ox Co and, later, Combustion Appliances Co; numerous patents were taken out on industrial instruments. The Franklin Institute, Philadelphia, awarded their Certificate of Merit to him and his brother, Chas W Hays, for their CO_2 Automatic Recorder development. Each edition of Jos W Hays' booklet, "How to Build Up Furnace Efficiency," referred to as the "fireman's Bible," increased in size and popularity.

During World War I, Mr Hays prepared pamphlets on combustion and flue-gas analysis for U. S. Fuel Administration and cooperated with the Government's fuel economy program. In 1918, he moved to Michigan City, Ind, and organized Jos W Hays and Associates, as consultants, and the Jos W Hays Corp, for the instrument business.

Following World War I, he wrote the Hays correspondence courses in "Fuels and Combustion," with authorities like Fred R Low, Joseph Harrington, W L Abbott, I E Moultrop, David Moffat Myers and Prof S W Parr as advisory editors. The Hays Institute of Combustion, Chicago, with Mr Hays as educational director, trained thousands of engineers in many lands.

In 1925, Mr Hays sold the instrument business to Phil T Sprague and devoted his time to his consulting practice and other activities. For six years he assisted Mid-Continent Petroleum Corp, Tulsa, Okla, in reducing fuel bills through more efficient combustion practices. The Chicago section of American Society of Mechanical Engineers honored him at a dinner, May 9, 1941, for "public service in developing the science of fuel combustion and fuel economy and for promoting its study."

Midwestern Pioneers

In his last years, Mr Hays' writings were largely about midwestern pioneers of what he liked to call "the heroic period of American life." He contributed to engineering magazines and dug up interesting facts for a book "Sidelights of American History."

Jos Hays never pretended to be anything but a worthy scion of the kind of folks who built this country. In his democratic simplicity, sympathetic liking for people, sharpness of wit and great respect for the laws of the universe, there was a dignity that made many think of Abraham Lincoln.

Nothing could have pleased Joseph Weller Hays more and been closer to the truth than to call him a pioneer, with the independent spirit and resourcefulness of his forbears, "who," he once said, "did not have a sissy, a molly-coddle or a gimme-gimme in the whole lot of them."

Turbine-Driven Pump Under Fifth Avenue Regulates New York's Water Pressure

Under a busy, cosmopolitan street corner a 500-hp water-turbine-driven pump acts to reduce pressure on the Catskill system and increase pressure of the Croton water supply

▶ A LARGE HYDRO-POWER plant is about the last thing that most people would expect to find at Fifth Avenue and 40th Street. Yet there is one in an underground vault adjacent to New York's magnificent Public Library where thousands of people pass each day without suspecting that they are close to one of the great city's rare sights. Here's how it came to be built.

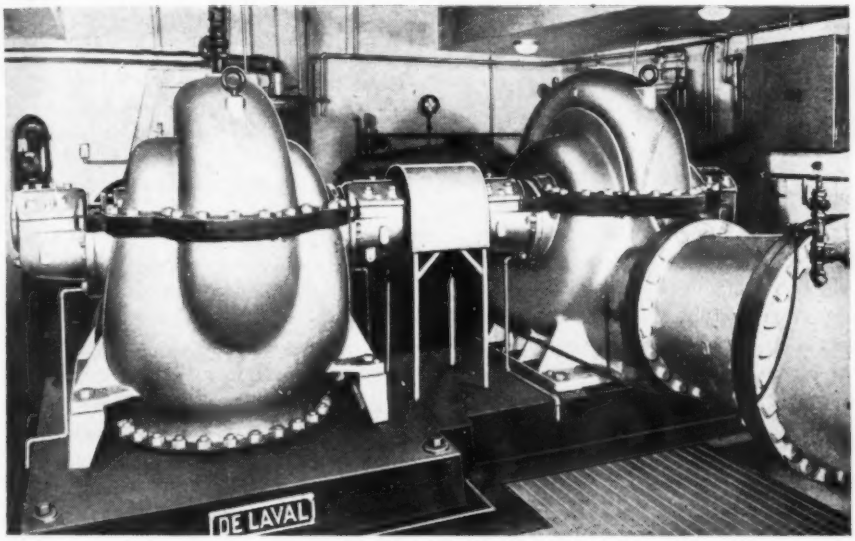


Fig. 1—Water turbine, right, uses excess Catskill pressure and provides motive power for pump, left, which increases pressure of water from the Croton system

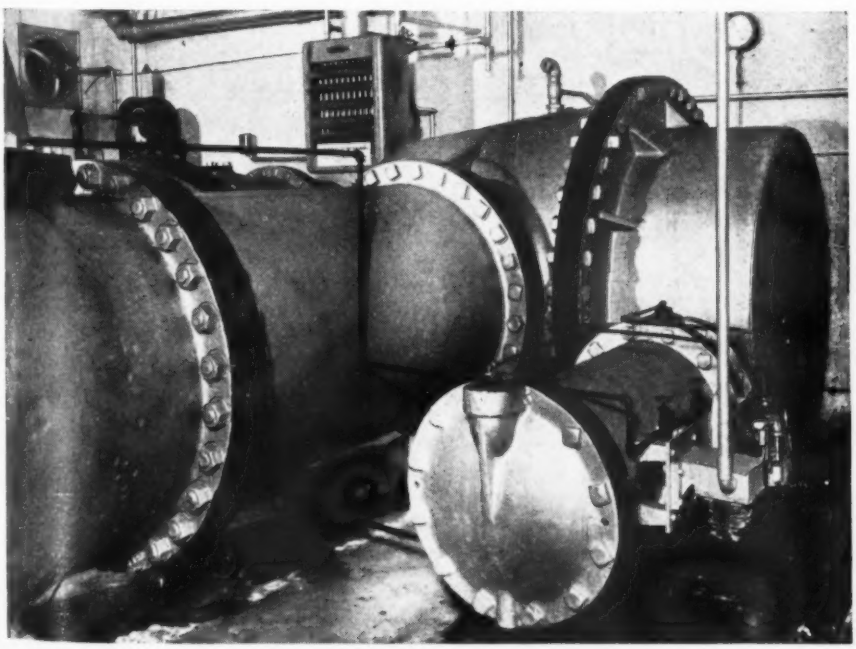


Fig. 2—This cone regulating valve in water-turbine discharge throttles automatically if the pressure drops below 30 psi and opens when normal pressure returns

Delivering and distributing approximately 900 mgd of water in New York's five boroughs involves three main sources which supply water as follows:

Over 60% from the Catskill system
About 30% from the Croton system
Remainder from Long Island wells

New reservoirs and aqueducts now under construction will bring in an additional high-level supply with an ultimate capacity of 540 mgd by tapping upper Rondout Creek, Neversink River and the east branch of the Delaware River. The city expects the initial installation of 170 mgd to be available the latter part of 1945.

Water-Distribution System

In the borough of Manhattan water is distributed through closed service zones the boundaries of which are determined by street-surface elevations. The intermediate service zone which extends downtown from 103rd St, is in turn divided into three areas for operating convenience and more uniform distribution pressure:

Upper area—103rd to 57th St
Middle area—57th to 34th St
Lower area—downtown from 34th St

Only about one-third of the Croton supply can be distributed by gravity since the Croton head is too low to furnish 40 psi, which is about the pressure maintained at street level. Pumping is, therefore, necessary to use more water from this system. Earlier pumping plants were steam driven but as greater utilization of Croton water has become necessary in recent years, the city has installed motor-driven pumps.

Catskill water reaches the city at a pressure of about 125 psi at sea level and can, therefore, be distributed by gravity through regulating valves to most parts of the city. Approximately 150 mgd from this system were used in Manhattan's intermediate zone prior to building the 40th St pumping station. When this water flowed into the distribution system, head loss through the reducing valves represented from 15 to 25 hp continuously per million gallons per day, depending on pressure drop.

Unfortunately, there are few loca-

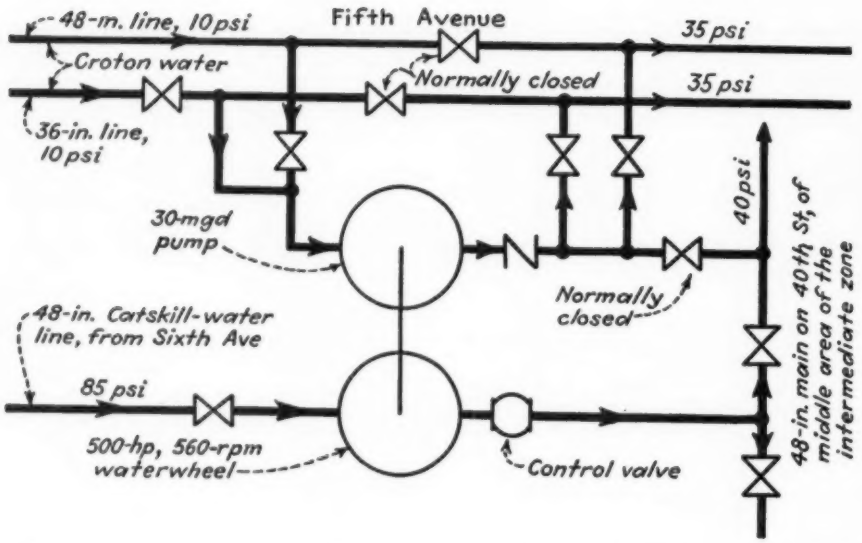


Fig. 3—Diagram shows how turbine uses water at 85 psi from the Catskill system to drive a pump to raise Croton system pressure from 10 to 35 psi

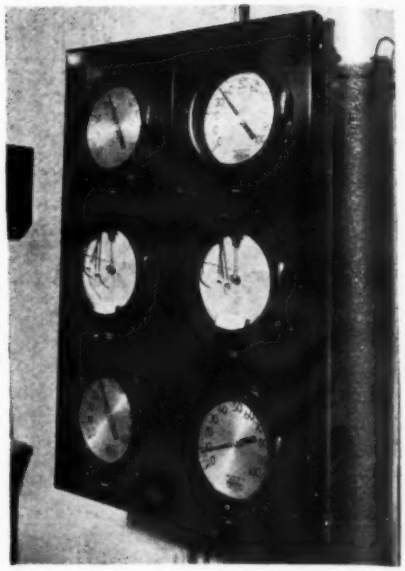


Fig. 4—Meters show inlet and discharge pressures of the turbine and pump

tions in the city where Catskill water can be used economically for power. But in 1940, when the water-department engineers were considering how to use more Croton water in the intermediate zone, they found that some of the Catskill water could be employed to operate a water-turbine-driven pump, see Fig. 1 and 5.

Space was available to build the pumping plant in an underground vault on public property at 40th St where there are two 48-in. and two 36-in. Croton water mains under Fifth Ave., Fig. 3. A 48-in. main on 40th St, for 57th-to-34th-St area, was supplied through a pressure regulator from shaft No. 17 of the Catskill water system at the corner of 41st St and Sixth Ave.

The pressure difference existing between the Catskill system and the 48-in. main on 40th St, about 45 psi, was wasted through the pressure regulator. It was decided to use this pressure in a water turbine to drive a pump to increase Croton water pressure. As shown in Fig. 3, a 48-in. main was run from Catskill shaft No. 17 to the water-turbine inlet and its discharge was connected to the 48-in. main, on 40th St. Pressure in this main is 40 psi and that in the turbine inlet is 85 psi, a difference of 45 psi.

Suction of the turbine-driven pump, is taken from one 48-in. and one 36-in. Croton main under Fifth Ave where pressure is about 10 psi, see Fig. 3. The pump discharges at 35 psi below closed valves in the same mains that lead into the area below 34th St. Thus, discharge of pump and turbine do not mix but flow into different systems.

The area below 34th St is also connected to the Catskill system, through regulating valves at shafts 18 and 19. to supply the demand above the turbine-driven pump's capacity. If warranted, it is also possible to mix the discharges from pump and turbine to supply a single district. However, to absorb the total output of both, approximately 65 mgd, the district must be large. Demand in the 57th-to-34th-St area in excess of the turbine discharge is automatically taken care of by regulating-valve connections from the Catskill-system shafts 16 and 17 into that area.

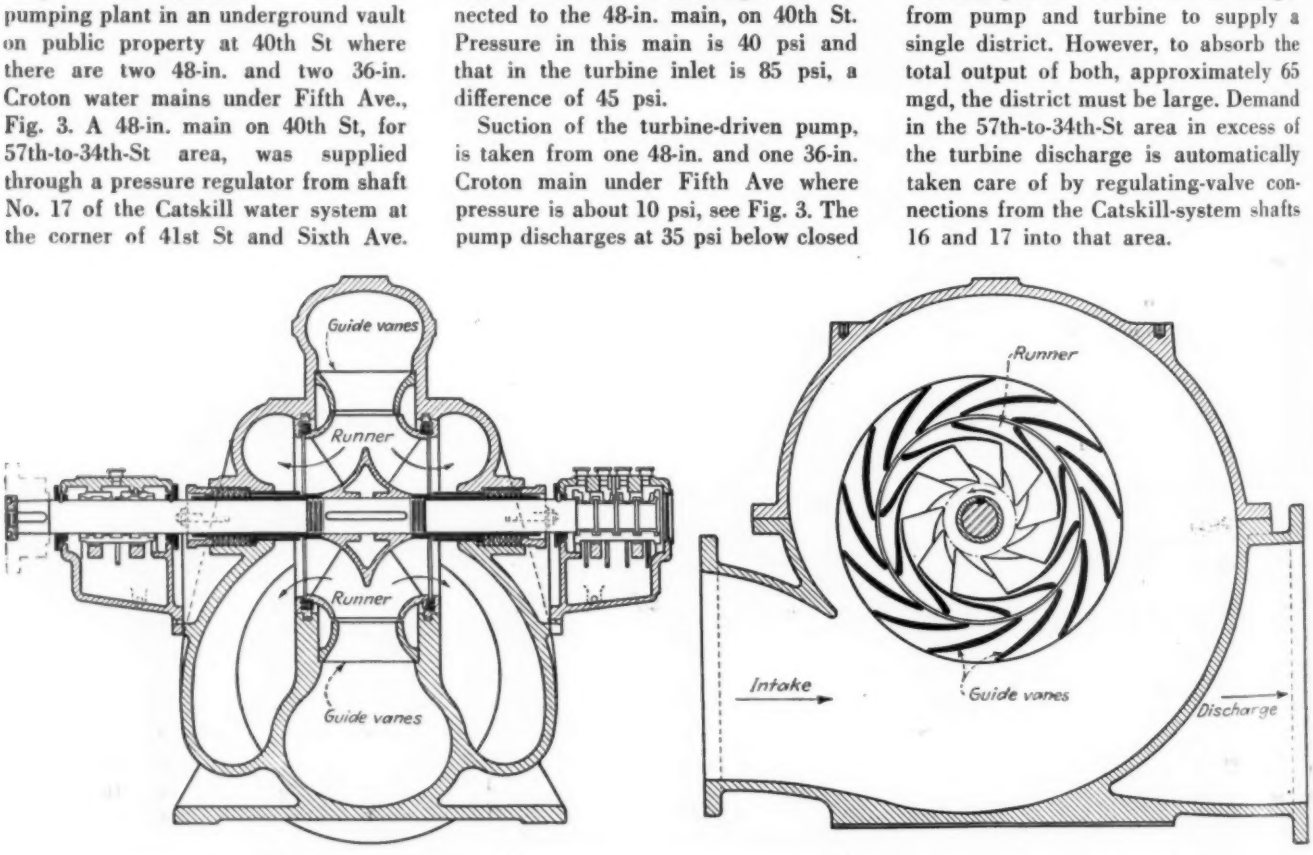


Fig. 5—Cross-section through water turbine. Inside their casings both pump and turbine are practically identical except that a guide-vane ring has been added in the turbine volute to direct water flow into the runner to improve its efficiency

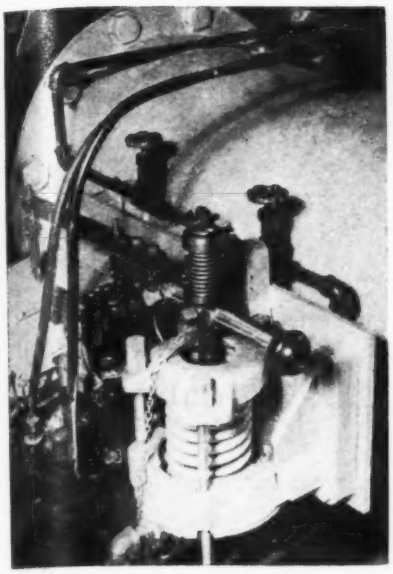


Fig. 6—Regulator controls turbine to maintain 35-psi pump-discharge pressure

Both pump and turbine, built by DeLaval Steam Turbine Co, are standard units. In this installation, pump and turbine casings are practically identical with the exception of location and size of inlet and outlet connections. The turbine has a 24-in. intake and 30-in. discharge, both of which are horizontal. The pump, with a 30-in. bottom suction, has a 24-in. horizontal discharge. Inside their casings both pump and turbine are practically identical except that a guide-vane ring has been added in the volute of the turbine to direct water flow into the runner and improve its efficiency, Fig. 5.

Turbine runner and pump impeller are also similar except that their blades have opposite curvature. Designed for a flow of 20,800 gpm, the turbine operates on a differential head of 45 psi and develops 500 hp at 560 rpm. The pump, rated 21,000 gpm (30 mgd), discharges against a 35-psi head, made up of 10-psi positive suction head and 25-psi discharge head.

Valve Locations

Limited space made it necessary to locate all gate valves outside the pumping plant under the 40th St sidewalk where they can be operated manually or by one of the city's portable operators. Inside the station, a non-slam 30-in. check valve is installed in the pump discharge and a 30-in. automatic cone regulating valve, Fig. 2, in the turbine discharge, both built by the Chapman Valve Mfg Co. The automatic regulating valve has a clear waterway of the same diameter as the discharge line and as a result head loss through it is practically zero.

Operation of the regulating valve is by a double-acting servomotor (hydraulic piston in a cylinder) connected to two cranks on the stem of the valve's conical plug. During the first 25% of the operating-piston movement, the lifter crank comes into action to raise the valve off its seat. For the remaining 75% of piston movement the conical plug is rotated 90 deg to full-open position. Closing the valve reverses the order of these operations. First, the operating piston rotates the plug to its closed position and then moves the plug down into its seat.

An automatic regulator, Fig. 6, controls the turbine speed to maintain pump discharge pressure practically constant at 35 psi. A connection from the pump discharge leads to a point below a spring-loaded diaphragm in the regulator. If pump discharge pressure increases, it causes the regulator to admit water at 85 psi from the turbine intake to the valve-operating cylinder, to start the valve closing and slow down the turbine and pump. This in turn reduces the pump-discharge pressure. When discharge pressure returns to normal, the regulator comes to neutral position and stops further movement of the cone valve. If pump pressure drops below normal, operation just described is reversed to increase pump speed and return its discharge pressure to normal.

If the turbine discharge line were to rupture, the turbine, having full Catskill pressure across it, would race. Because of this remote possibility, the turbine was run at 1200 rpm in the shop to make sure that it would safely operate at runaway speed. The turbine is, however, protected against overspeed. When its discharge pressure drops to about 30 psi, a low-pressure switch closes, energizing a solenoid that causes the automatic regulator to close the cone valve. On return of pressure to the turbine-discharge line the low-pressure switch opens the solenoid circuit and the valve opens to start the turbine.

A Simplex Valve & Meter Co venturi meter on the pump and another on the turbine records the flow through each. In addition, Foxboro indicating meters on a panelboard, Fig. 4, show intake and discharge pressure of both pump and turbine. A 2-pen recorder for the turbine and another for the pump, record the inlet and discharge pressure of each. Therefore, even though the station operates without an attendant, on the inspector's daily trips to the plant he finds a record of all that has occurred since his previous visit.

The station was built under the direction of Patrick Quilty, commissioner, Water Supply, Gas and Electricity, and T Hochlerner, chief engineer. H R Sherman, mechanical engineer, was in immediate charge of design and construction of the plant.

Reduced Starting Current Cures Hoist Troubles

A 60-TON-PER-HR coal hoist gave us a lot of trouble. The magnetic brake failed to operate properly, the control contactors welded closed and teeth on a rawhide pinion on the driving motor sheared. Finally, a serious wreck occurred when the hoisting rope broke and let the bucket loaded with coal drop about 100 ft. This hoisting rope was a ¾-in. hemp-center regular-lay design, which failed in six months.

To correct the cause of our difficulties we replaced the hemp-center steel rope with a preformed rope of the same diameter that had a steel center. After this rope had given 19 months service, we replaced it because of wear and not because of broken wires in the strands. We also made changes that undoubtedly favored the rope life.

The 15-hp squirrel-cage hoist motor was started across the line under full load, with an inrush current of 110 amp at 440 v. This is nearly 600% of full-load current. The motor starting under these conditions developed a torque that subjected the entire equipment to excessive overloads, and the heavy inrush current was sufficient to weld the line contactor closed.

To reduce the starting current we installed a 500-ft coil of No. 6 copper wire in each of the outside conductors to the motor. This reduced the starting current to 70 amp, gave a smooth, easy start and stopped burning of the contacts, without reducing the capacity of the hoist. Later, we installed resistors to replace the coils of wire, and installed contactors to short-circuit them five seconds after the line contactor closed.

About 20 years ago I experienced similar trouble on a coal larry operated by a squirrel-cage motor started across the line. Motor winding burned out, larry wheels failed and the starter contacts gave trouble. In this case we cured the trouble by connecting the coils from two old ac ammeters in the two outside legs of the motor circuit.

Columbus, Ohio FRED E SCHUBERT

Fig. 1—Control cabinet for electronic dc motor control. Glowing thyratron tubes supply current to the motor field coils

Electronic Tubes Power Adjustable-Speed Drives

▶ MOST INDUSTRIAL PLANTS are supplied with ac power, but ac general-purpose motors are unsuited to applications requiring speed control. Special adjustable-speed ac drives are available, but frequently they do not meet the speed-range or speed-torque characteristics required for a given application. In many where dc power is available, standard dc motors do not completely fulfill all requirements, such as extremely wide, stable speed range, good speed regulation and smooth automatic acceleration.

To remove these limitations, electrical engineers have been turning their attention to electronic tubes to provide power for dc motors and to control motor speed from ac power lines. One such device is the Westinghouse adjustable-speed electronic motor drive, used in industrial applications that require constant preset speed over a 20:1 speed range and smooth automatic acceleration and retardation.

Electronic Motor Drive

In this electronic motor drive thryatron tubes supply a shunt-wound dc motor with direct current from a single-phase or from a polyphase system. As shown in Fig. 2, one set of tubes, *A*, supplies the armature current and another but smaller set, *B*, provides the field current. A potentiometer in the control station varies the voltage of the rectified direct current supplied to both field and armature circuit by shifting the phase of the grid-control voltage of the thyratrons. Three still smaller tubes, *H*, supply power for the control circuits. The system also includes a power transformer and a pushbutton control station. The latter, in the diagram, provides for reversing operation. Following through the circuits makes control performance clear.

How Control Operates

About five minutes are required to heat the thyratron tubes before the control can be put in operation. This delay occurs only when the line switch is closed. The control is designed to maintain continuous heating of the tubes even when the motor is stopped, unless the line switch is opened or the low-voltage protection operates. In the diagram, when the main switch is closed the time-delay relay coil, *TD*, is energized, which immediately closes its contact, *TD*, to put a short circuit between the field coils and their tubes *B*. This makes the circuits to the forward and reverse pushbuttons inoperative. After the time relay opens its contact, the control becomes operative and the motor field coils are excited.

The main transformer has one primary winding and two secondary windings, *CD* and *EF*. Winding *CD* supplies power to motor-field tubes *B* and to the control circuits, and winding *EF* supplies power to the armature through tubes *A*. Assume an instance when the voltage in transformer winding is from *C* to *D*. Current then flows from center connection *G* through the field winding, through the left-hand tube to terminal *C* of the transformer. The right-hand tube is inactive because current can flow from filament to plate but not from plate to filament. On reverse of voltage in the transformer, current flows from terminal *G* through the field windings and the right-hand tube to terminal *D* of the transformer. Even though the current reverses in the transformer winding, it always flows in the same direction through the field winding.

Assume that the forward pushbutton is pressed. This closes forward contacts in the armature circuit and tubes *A* supply dc power to the armature as explained for the field coils. Closing forward contacts *S* opens dynamic-braking contact *FB* to interrupt the dynamic-braking circuit. The motor armature now accelerates to whatever speed the control may be set for.

Pushbutton Control

If the reverse pushbutton is pressed, forward contacts open and dynamic-braking contacts close, quickly slowing the motor down to nearly zero speed. Reverse contacts *R* then close and the motor armature accelerates to its preset speed in the reverse direction. Pressing the stop button causes both contactors to remain open and the motor stops.

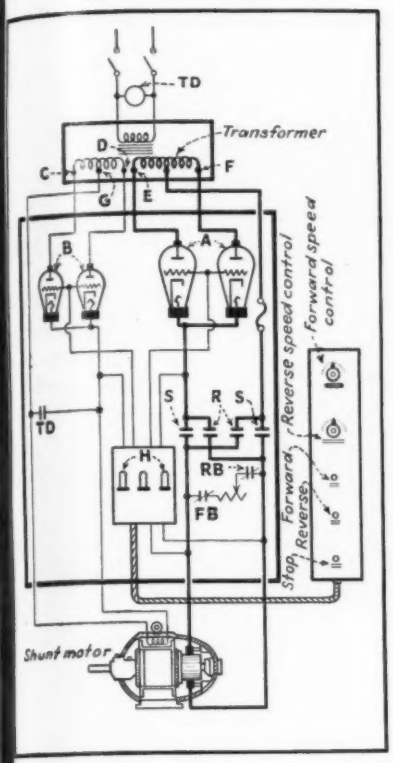
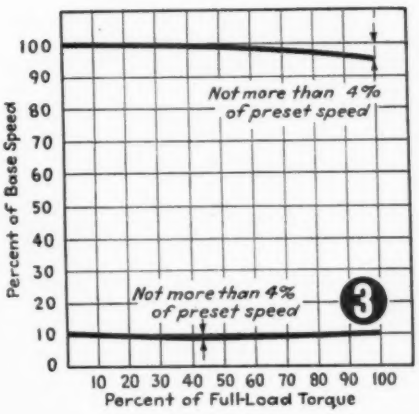


Fig. 2—Incoming ac power is converted to dc by thyratrons (grid-control rectifier tubes) for both the armature and the field circuits of the driving motor



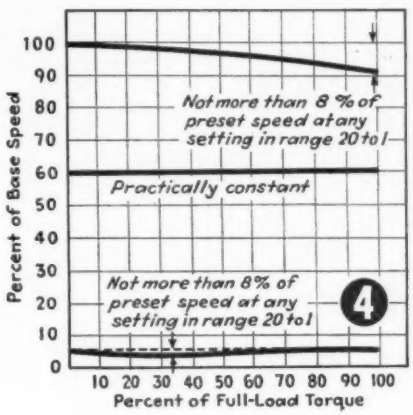

Not more than 8 % of preset speed at any setting in range 20 to 1
Practically constant
Not more than 8% of preset speed at any setting in range 20 to 1
4
Percent of Base Speed
Percent of Full-Load Torque

Fig. 3—A 10:1 speed range limits speed regulation to within 4% at either low or high speed. Fig. 4—A 20:1 speed range limits speed regulation to within 8% for both low and high speed, but constant speed can be obtained from zero to maximum torque at any speed within the operating range by proper adjustment of the speed compensation in the control

For industrial applications an electronic motor drive gives constant preset speed at varying loads over a 20:1 speed range and smooth automatic acceleration and retardation

Speed may be preset within the design range of the equipment with two speed-control potentiometer rheostats and reversing contactors. Different forward and reverse speeds may be preset. For example, pressing the forward button accelerates the motor to 300 rpm, while pressing the reverse button would cause the motor to stop, reverse and accelerate to a speed of 1500 rpm. Speed adjustment may be made at any time while the motor is in operation.

Base speed of the motor is that speed at which the motor operates when rated voltage is applied to its armature and field coils. Speed control below base speed is obtained by controlling output voltage of the tubes supplying power to the armature. Speed changes above the base speed are obtained by adjusting the voltages of the tubes supplying the field coils. Armature control can give a normal speed range of 20:1 below base speed, but a much wider range can be obtained, such as 100:1. Field control normally gives a speed range of 2:1 above the motor's base speed. If the base speed is 1000 rpm, then by field control the speed can be increased to 2000 rpm, but may be limited by mechanical stresses in the rotating parts of the motor.

Speed Regulation

In a standard electronic control, small control tubes regulate the voltage to the motor to maintain essentially constant speed. With a properly adjusted system, the speed over a range of 10:1 does not vary more than 4% from a preset value, for a load range of from zero to full, Fig. 3. For a speed range of 20:1, the speed does not vary more than 8% from no load to full load. Fig. 4. Constant speed can be obtained from no load to full load, at any speed within the operating range; for example, at 60% of base speed. Fig. 4. Normal variations in ac voltage have only small effect on speed regulation.

Motors used with electronic control are selected to handle constant-torque loads over the armature-control speed range (or up to the base speed of the motor) and drive constant horsepower over the field-control range continuously without exceeding safe temperature limits. Frame size of the motors depends upon the base-speed rating and other operating characteristics. In most ratings, frames are somewhat larger than those for standard dc motor of the same horsepower and base-speed rating, because of the high form factor of pulsating current obtained from the rectifier when the firing angle is phased back to obtain low-output voltage and consequently low motor speeds.

Motor Started at Full Field

The control is arranged so that the motor is always started at full field regardless of the setting of the speed potentiometer. If the speed is set above base speed, with weakened field, the speed control does not become effective and the field is not weakened until the motor reaches base speed. Fast, smooth acceleration is automatically obtained through special current-limiting devices built as part of the standard unit.

A current-limiting device works from a small auxiliary control tube, which controls the firing of the main rectifier tube. Thus, the voltage output of the rectifier is such that a preset current limit is not exceeded. For general applications the current-limiting device may be set to operate over a wide range up to 200% of rated full-load motor current, so that accelerating characteristics may be varied to suit load conditions. If unusually high starting currents are required, rectifier tubes must be carefully chosen for their peak ampere ratings, even though the running load conditions do not exceed the average ampere tube rating.

Vibration difficulties sometimes encountered with adjustable-speed drives have been minimized, as the dc motor is the only rotating part. No separate linestarter or field rheostat is required. The control may be mounted in its own cabinet or installed directly in the driven machine.

The Old Chief

Creeping Jimmy

Another in a series by William Doran, chief engineer, Essex County Sanatorium, Windsor, Ontario. Writing of the past, he captures much of the human, colorful side of engineering

► LOOKING BACK into the old plant's history, we find on a May morning in the year 1910 that the timekeeper took from the board a brass check numbered 23 and handed it to a new man named James D McQuarty—to give him his wrong surname.

From the records we read that the man's eyesight was OK and he was free from rupture; that he was hired as an experienced fireman and his other qualifications were journeyman millwright and iron turner. It was so long since I have heard a machinist described as an iron turner that for a while I wondered what it meant. We also learn that he was hired at five cents an hour above the top rate for fireman, a fact that would indicate that good firemen were scarce at that time.

23 Years Service

By a strange quirk of fate, the man with check number 23 worked exactly 23 years to the month in the plant before leaving to join his brother in a farming venture.

In the old plant, 23 years is by no means the record for long service, but Jimmy had something more than his long service to cause him to be remembered. He was a character and a man apart from the procession of names that fill the pages of the old employment book.

There were a number of Jimmys in the shop so when some of the young squirts nicknamed him "Creeping Jimmy" the name somehow stuck and he earned it by the quiet manner in which he moved around the plant. He was the quietest man I even met. When he spoke at all, it was in a low voice. He was quiet of manner, quiet of dress, you might even say quiet of thought.

His nature seemed to affect everyone and everything he came in contact with. You could tell when he was running a shift. There was less banging of fire irons. The fans drummed a few notes lower. The old pumps whined in a lower octave and the Corliss cushioned with easy regularity. Loud-spoken men might be having a hot argument but when Jimmy came along their voices would drop to a conversational tone.

There were times when the plant was running "away over its head," and things were always one step ahead of the operators. It was during one of these times that I heard a loud and vigorous young fireman complaining with heat about how the "so-and-so" plant was left by the "so-and-so" foreshift. He was waxing indignant about the water, the fires, the pumps and all the other things he had to straighten out. "What do you think of it?" he demanded of Jimmy. "What do you think of it?"

Jimmy smiled, then as he continued on his way, he said, "Maybe, son, someone is trying to make a good engineer out of you."

The Old Chief always laid down as one of his tenets that the power-plant business should never be discussed with the members of any other department in the factory. On one occasion an engineer was reported for libeling a fellow engineer outside the plant. The Old Chief ordained that the culprit be transferred to work as Creeping Jimmy's mate for one year, and added, "If that don't learn him to stop talking out of turn, nothing ever will."

I looked upon Creeping Jimmy as a man who was leading the life we all should lead. There was faith in his quiet smile, honesty in the quiet nod or shake of his head that often took the place of conversation. I was very much interested to know how Jimmy had achieved his serene attitude towards life and, strange to relate, I found out.

One warm night I spied Jimmy coming from a trade lecture. I drove him home and we talked for an hour in front of his house. I had thought his nature might have resulted from religious experience or early training, but I shot wide of the mark.

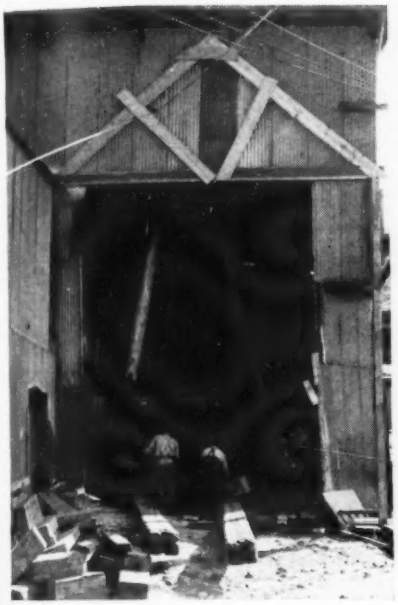
Jimmy told me that he came of a hard-drinking family and that he had ruined his kidneys by drinking hard liquor in his young days. A doctor told him to swear off and he did. He also explained that he had a very sensitive throat and if he talked much it brought on a painful condition. So those were the reasons he moved quietly and spoke little! While I would not wish the cause on anyone, I do wish the effect could be induced in some people I know

"Maybe, son, someone is trying to make an engineer out of you."

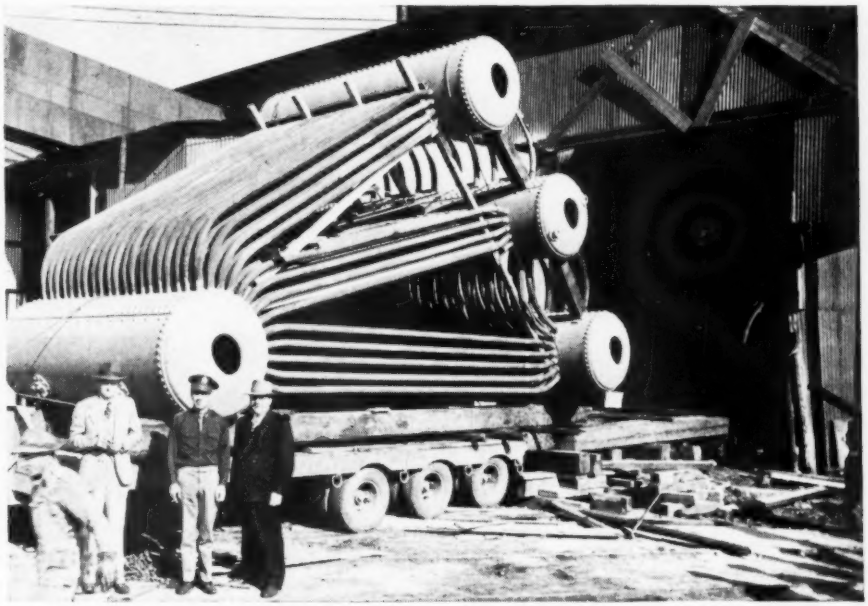
Practical suggestions for creating emergency capacity . . . substitutes for hard-to-get parts and materials . . . cures for overloads, breakdowns . . . ways to build up short-handed staffs. Share your ideas! Send in your rough notes and photos or sketches. Payment at regular rates

WARTIME POWER CLINIC

A CALIFORNIA BREWERY GOES TO WAR



Dismantling boilers at the abandoned Buffalo Brewery, Sacramento, California



Boiler leaves for its new war job. Left to right, Mr Hart, U. S. Engrg Dept, Capt Thompson, U. S. Engineers, and Frank M Beeson, Beeson Bros Engrg Co

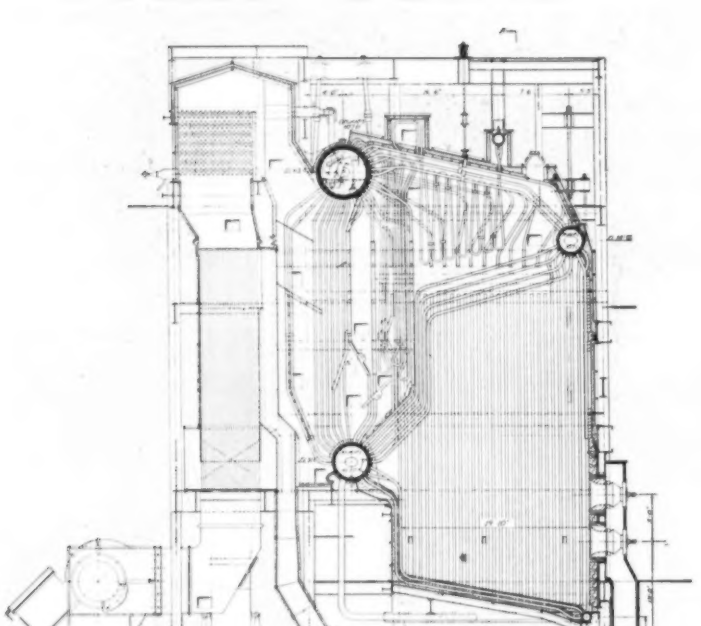
Transporting the big boilers through the streets of Sacramento required special equipment to prevent contact between the boilers and the overhead lines

VARIED AND INTERESTING is the engineering work that is converting industrial plants to wartime jobs. The remanufactured material generally saves many months in getting a new plant into operation, while salvaging large amounts of critical materials and equipment.

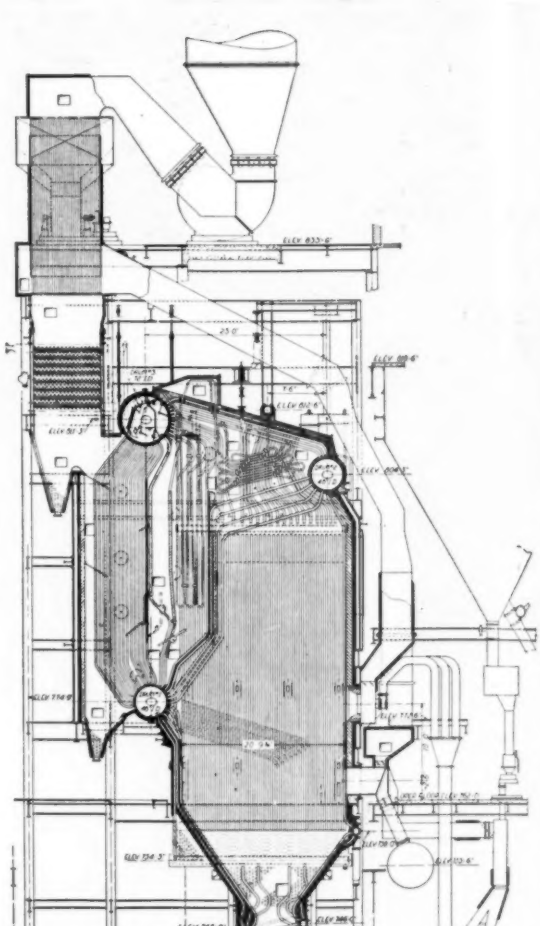
One of the most unusual projects is now under way in Sacramento, Calif., at the old Buffalo Brewery, built years ago as a product of the California gold rush. When it was rebuilt in 1908 it was considered the finest plant of its kind and a model of efficiency in the industry. Today, after 34 years, the steam equipment is still in usable condition. Under the direction of Beeson Bros Engrg Co, Los Angeles and Sacramento, remanufacturers of power machinery, it is being completely dismantled for war use. All piping, pumps, boilers, and everything else but the actual brewing equipment—even the smokestack—are being moved, redesigned and re-engineered.

(CONTINUED ON PAGE 98)

Four Recent Installations of R



450,000 lbs. of steam per hour. 1425 lbs. Pressure. 900° F. Temperature. 80.6% Efficiency with 400,000 lbs. Natural Gas Fired. Furnace Depth 19'10". Furnace Width 35'10"



300,000 lbs. of steam per hour. 750 lbs. Pressure. 760° F. Temperature. 86% efficiency with Coal. 80.2% efficiency with B.F. Gas. Pulverized Coal and Blast Furnace Fired. Furnace Depth 20'9¾". Furnace Width 23'1½"

Here are four recent installations of RILEY Steam Generating Units

...good examples of the character of installations being made by Riley in so many of the leading industrial and central station plants. This swing to Riley has, according to U. S. Department of Commerce figures, increased the sales of Riley Units more than three and a half times as rapidly as total industry sales . . . made Riley sales in 1942 over 1400% greater than in 1931 and over 800% greater than in 1938.

The outstanding performance of existing Riley installations has brought about this tremendous increase in sales. Riley

TRADE MARK REGISTERED

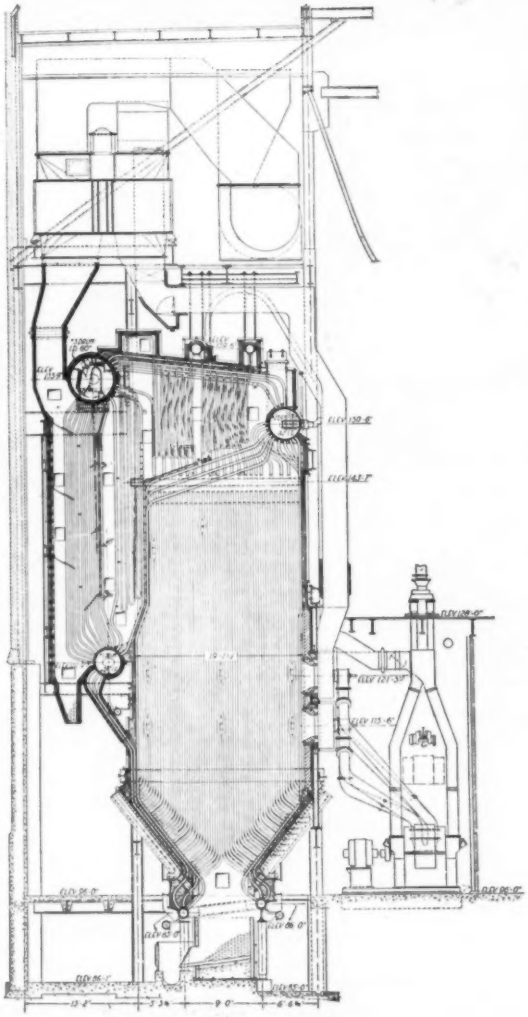
RILEY

STOKER CORPORATION, WORCESTER, MASS.

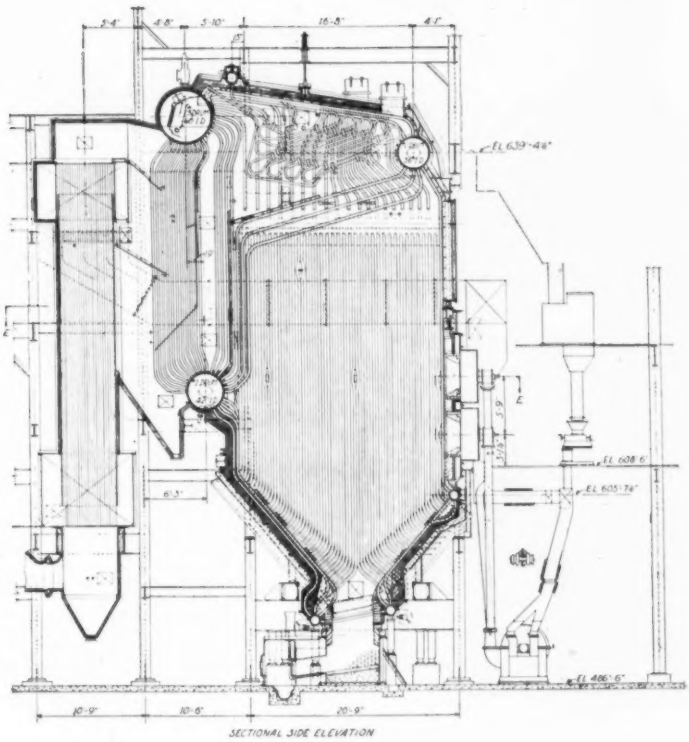
Boston New York Philadelphia Pittsburgh Baltimore Buffalo Cleveland Detroit Chicago St. Louis Cincinnati St. Paul Kansas City Denver Seattle Portland Los Angeles Houston New Orleans Atlanta Memphis Richmond

It will pay you to visit modern Riley Installations

Riley Steam Generating Units



300,000 lbs. of steam per hour. 975 lbs. Pressure. 825° F. Temperature. 85.3% Efficiency @ 250,000 lbs. Pulverized Coal Fired. Furnace Depth 19'1½". Furnace Width 21'11¼"



SECTIONAL SIDE ELEVATION

250,000 lbs. of steam per hour. 475 lbs. Pressure. 700° F. Temperature. 85.3 efficiency @ 225,000 lbs. Pulverized Coal Fired. Furnace Depth 19'1⅜". Furnace Width 19'6"

performance invariably exceeds guarantees. Results of twenty-three recent tests showed actual efficiencies exceed guaranteed efficiencies by 1.405 points. Actual capacity also far exceeded guarantees.

Complete satisfaction has also resulted in a very large number of repeat orders for Riley Units . . . in recent years one company placed 7 different orders for a total of 20 units; another 6 orders for 14 units; another 6 orders for 11 units; another 9 orders for 9 units. Good proof of the satisfactory results being obtained by users of Riley Steam Generating Units.

Riley manufactures units from 7500 pounds of steam per hour up.

A survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power cost

COMPLETE STEAM GENERATING UNITS

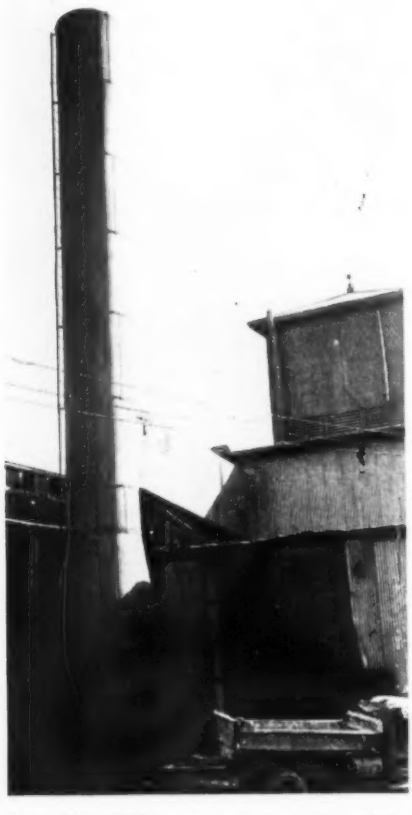
BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS
ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

before purchasing Boiler or Fuel Burning Equipment

(CONTINUED FROM PAGE 95)

When the job is completed, the steam equipment will become two entirely separate heating plants, hundreds of miles apart, at two large war plants by Beeson Bros in the Sacramento District of the U. S. Engineering Dept.

An interesting feature of the project is that each of the two plants will supply more steam than the original single plant. This is partly because of an increase in boiler capacity and efficiency by reversing the position of the firebox and firing from the opposite end of the boilers. Beeson engineers have made other important changes to adapt this brewery equipment to its new double-duty job.



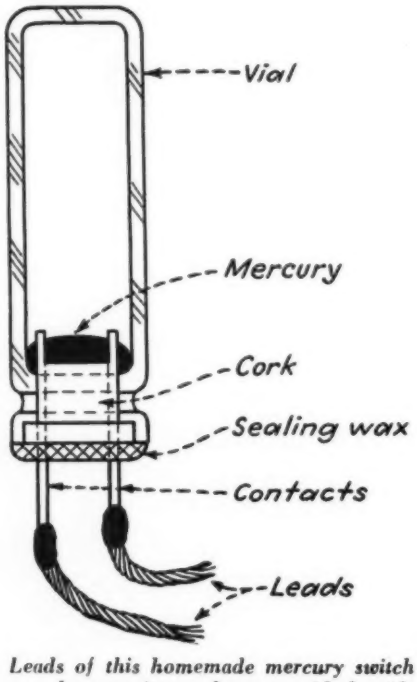
Even the old brewery smokestack will be moved and reassembled at the final location for use with the steam equipment being installed by Beeson Bros

Simple Mercury Switch

THE PRIORITIES SITUATION forces us into many homemade solutions for parts. One such solution is a replacement for a mercury switch, see sketch. It is assembled from a small vial, such as is common for cologne or medicine (Carter's Little Liver Pills, to be exact), a drop of mercury, wire contacts and wax from a discarded dry cell.

The contacts may be small strips of copper fitting closely between the cork and the glass. They may be located opposite or almost touching each other, as required. The only fussy job is applying the wax. Keep the mercury away from the hot end because mercury vaporizes at low temperatures and builds up pressure rapidly if heated. Furthermore, the vapor is poisonous.

Falls Church, Va. J C RUNYON
Consulting Engineer



Leads of this homemade mercury switch may be opposite, as shown, or side by side

Metallizing Restores Press Ram

For the original report on which this summary is based, G E Morgan, General Machine Foreman, Pressed Steel Car Co, won a $150 War Bond in the Metco Conservation Contest.—Editor

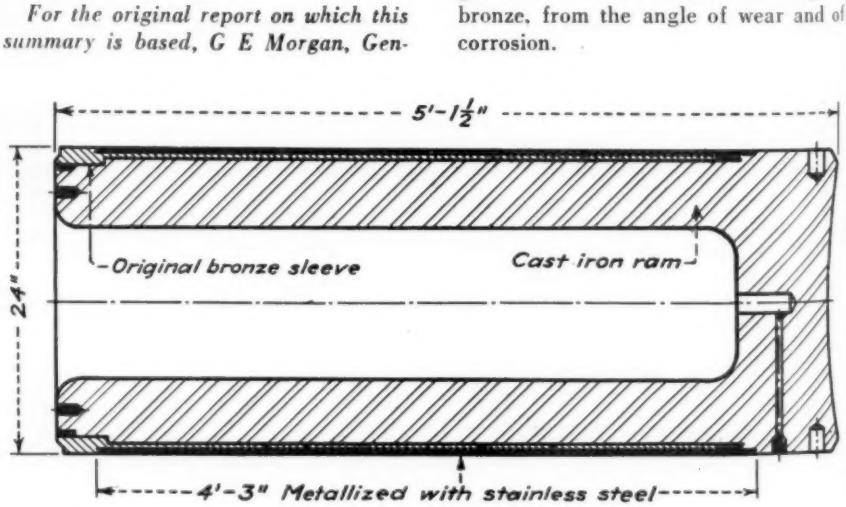
Recently, the Pressed Steel Car Company's McKees Rocks plant, in Pennsylvania, used metallizing (sprayed metal) to recondition the ram of a 1500-ton hydraulic press. The operation made it unnecessary to order a 2300-lb bronze casting for a new sleeve. This expedient also saved over 50 hours of labor.

As shown in the sketch, the worn bronze sleeve was built up with sprayed stainless steel, as follows: After being completely dried and then cleaned with carbon tetrachloride to remove grease and oil, the ram was prepared for metallizing, first by grooving and then by applying Metco rotary shaft preparing tool.

Using a Metco 2E gun, approximately 340 lb of ⅛-in. Metcoloy No. 1 stainless steel was applied. This added slightly more than ⅛ in. of sprayed metal on the radius, thereby allowing about ⅛ in. for finishing. After spraying, the ram was rough machined to within .015 in. and was then finish-ground with a Dumore-Metco lathe grinder. Setup and preparation time prior to metallizing was 9 hr. Rough machining took 16 hr, actual spraying 32 hr, grinding 8 hr—a total of 65 hr of labor.

Against this must be set the 118 hr that would have been required if the bronze sleeve had been replaced, as had been the previous practice. Such replacement was a big and costly job on this 3-ton 5-ft-long ram.

In the metallizing process any metal may be applied over any other. Here the use of stainless steel over the bronze gave a better surface than the original bronze, from the angle of wear and of corrosion.



After cleaning and otherwise preparing surface of worn bronze sleeve, it was metallized with stainless steel to an excess radius of 1/16 in., later removed by machining and grinding. As compared with a new sleeve, this procedure saved over 50 hr of labor and avoided the purchase of a $1200 2300-lb bronze casting

Engineering Design
—Creator of America's Mechanized Might

In war, as well as in peace, the design engineer is the vital link between the inventive mind and the mass-production reality

It is gratifying and interesting to note that reports of new "secret weapons" not only have reversed their course during the past few months . . . they also have increased in frequency. Once they filled us with dread and misgiving. Today the enemy does the worrying.

Word about the latest new Army weapon reached us as this was being written . . . a 2½ ton truck that performs on water as well as on land with equal efficiency. "The Duck", resembling an overgrown amphibious jeep, is particularly suited to landing operations where docks are lacking. Loaded with 20 fully equipped soldiers or their equivalent in supplies, its propeller runs it ashore. It climbs the beach on its six-wheel drive and continues the trip on land.

This important addition to our "second-front" fighting equipment, coming so closely on the heels of the now famous tank-killing "Bazooka", is one of many history making contributions of American design engineers — the men who transform nebulous ideas into practical realities — the men who make our war machines superior to those of our enemies.

Invasion and eventual victory became a certainty as soon as America's design engineers threw their full effort into the war against aggression. Adapting intricate ordnance designs to mass production, these men developed weapons such as the M-10 destroyer of Rommel's tanks and brought out the new fighting planes and bombers that have won the air superiority that has turned the tide against the Axis. Taking ideas and giving them form, selecting the materials of construction, deciding upon the method of fabrication, adapting the electrical and mechanical parts that power the product, specifying the finish that protects and beautifies it . . . these men are the focal point of American production. Their ingenuity has no parallel. Once they put automobiles on a mass production basis and within the reach of all. Today, after less than three years and with little previous experience in armament design, they have brought America's war weapons to the highest efficiency . . . surpassing Hitler's weapons despite all the vaunted scientific wizardry of the Germans and their ten year start.

At this point it is well to remember that while Germany's military might is traceable to its superiority in armament, many of the basic technological discoveries (including the airplane and the submarine) are the products of American genius. The Germans always have been aware of the military advantages of technological superiority and have forced its expansion with all their might. They knew that mobility and surprise play a decisive role in modern warfare and their design engineers were kept busy, with unique intensity, to achieve unprecedented results in fast-moving, hard-hitting fighting equipment. Our own military and industrial engineers did not go into action until it became certain that we would be involved in the conflict. But even before our country actually embarked on its Preparedness Program they were busily engaged in developing the designs of our war equipment. Tanks, planes, guns, ships and hundreds of other apparatus and machines of war were studied. Carefully selected committees of our national engineering societies were organized under the leadership of the Army Ordnance Department to serve as advisors and consultants in the development of advanced designs of tanks and other motorized equipment of war. The above mentioned "Duck" and the now famous Sherman tank are just two of the many results of these efforts.

After the Preparedness Program had officially been launched and Congress had made its initial appropriation, it was necessary to create the manufacturing blueprints from which the engines of war could be built. Because the designs of the machines of production, as well as the designs of the products themselves, determine the speed and economy with which anything can be manufactured,

This is the thirteenth of a series of editorials appearing monthly in all McGraw-Hill publications, reaching more than one and one-half million readers. They are dedicated to the purpose of telling the part that each industry is playing in the war effort and of informing the public on the magnificent war-production accomplishments of America's industries.

the capacity of our industrial system is dependent, to a considerable extent, upon the ability and ingenuity of American design engineers. Germany's military might was successfully mechanized because Germany, for more than 10 years preceding the war, was riding the wave of a world-wide technological revolution. This revolution was as far-reaching as the advent of the electric motor and the internal combustion engine. It was born of the profusion of inventions and discoveries since the last war. German design engineers took advantage of every one of these.

If we are to defeat our enemies and if we are to continue to play the leading role in the post-war world we must make better use of the new technology than do our enemies. The job is up to American product engineers who already have made tremendous strides in designing the intricate machinery of production and of war equipment. Much remains to be done however.

It has been said that the Germans have not developed one single item that can be classified as basically original, nor are there indications that any so-called "secret weapon" will henceforth be developed by them. Today the Nazis are completely outclassed by the tremendous manpower of engineering brains that is at the disposal of American industry. Although we were faced by the same fundamental problems of shortages in materials, manpower and time, our engineers not only solved these problems quickly and effectively, but they outstripped the enemy by the preponderant weight of talent which we were able to bring to bear upon our problems. As is evidenced by studies of the designs of captured German war equipment, our airplanes are faster, carry heavier loads, have superior protective armor and heavier armament. Our tanks, especially the Shermans, stand unmatched. Our tractor-mounted artillery excels theirs in fighting power. Our automotive vehicles are the envy of the world. Our battleships are supreme. Our signal and detection devices are frustrating all of our enemies' attempts to dominate the seas.

And as we approach the end of the conflict, the pattern of which already has been set, the forces that converted American industry from peace to war-production will again be brought into play, and the product engineer will continue to be the fulcrum. Our post-war industry will grow from his blueprint. Nor will his job be any less urgent, any less responsible, any less sweeping in its effects than were his efforts during the war-preparedness program.

Since the cessation of the manufacture of peace-time goods, many new materials and production techniques have been developed. Plastics, synthetic rubber and magnesium in the field of materials were relatively new and restricted in their uses when war came. So were powder metallurgy, induction heating, electrostatic heating, adhesives for joining metals and compressed resin-impregnated wood. The new possibilities in product design created by the electronic devices and applications developed during the war period virtually stun the imagination and the "atomic revolution" promises to change the entire pattern of manufacturing operations.

Never before has there been so much speculation about the future as there is today. Looking forward, who can doubt our limitless capacity to continue our industrial world leadership?

While no one can predict developments in product design in the post-war period, certain it is that they will be so vastly different and so far superior to existing designs that they will obsolete most products as we know them today. With engines of vastly superior metals, designed to burn 100 octane gasoline and built to a precision ten times greater than that of pre-war engines, our post-war automobiles will give from 40 to 60 miles to the gallon. Tires will last from forty to fifty thousand miles. The comfort and smoothness with which these cars of tomorrow will glide along are undreamed of today. Polaroid windshields will eliminate the glare of oncoming headlights and the driver will need to give but scant attention to the manipulation of his simplified gear shifts.

According to no less an authority than Igor Sikorsky, we stand on the threshold of a new air age in which the helicopter will contribute to the greatest prosperity we have ever known.

Prophecies are hard to make at a time like this but speedy house building seems to be a certainty in the world of tomorrow. Air conditioning, new methods of heating, humidifying and drying, promise to be necessities in the post-war home. Vacuum sweepers will be much lighter, less noisy and easier to manipulate. Washing-machines will be fully automatic and practically free of noise and vibration. Not only will our homes and most of the furnishings be of radically new design, but so will the factories and machines that produce them.

Only one factor can prevent the fulfillment of the dream of the product designer. His job is not accomplished over night. To convert sound ideas into production blueprints involves a great deal of time and money. The building of test models is an expensive and tedious procedure. An abundance of seed money is required to perfect the product, to develop mass-production methods and to bring it to fruition as a finished saleable product.

It is the patriotic duty of every industrial leader to hasten these developments so that the material benefits created by them may speed our progress along the road of abundance.

President, McGraw-Hill Publishing Company, Inc.

Turbines Lend Versatility to Auxiliary Drive

Turned to efficient use, exhaust steam from a wide variety of modern turbines can do the job of driving fans, pumps and other auxiliaries better than motors can, according to F K Fischer, steam engineer, Westinghouse

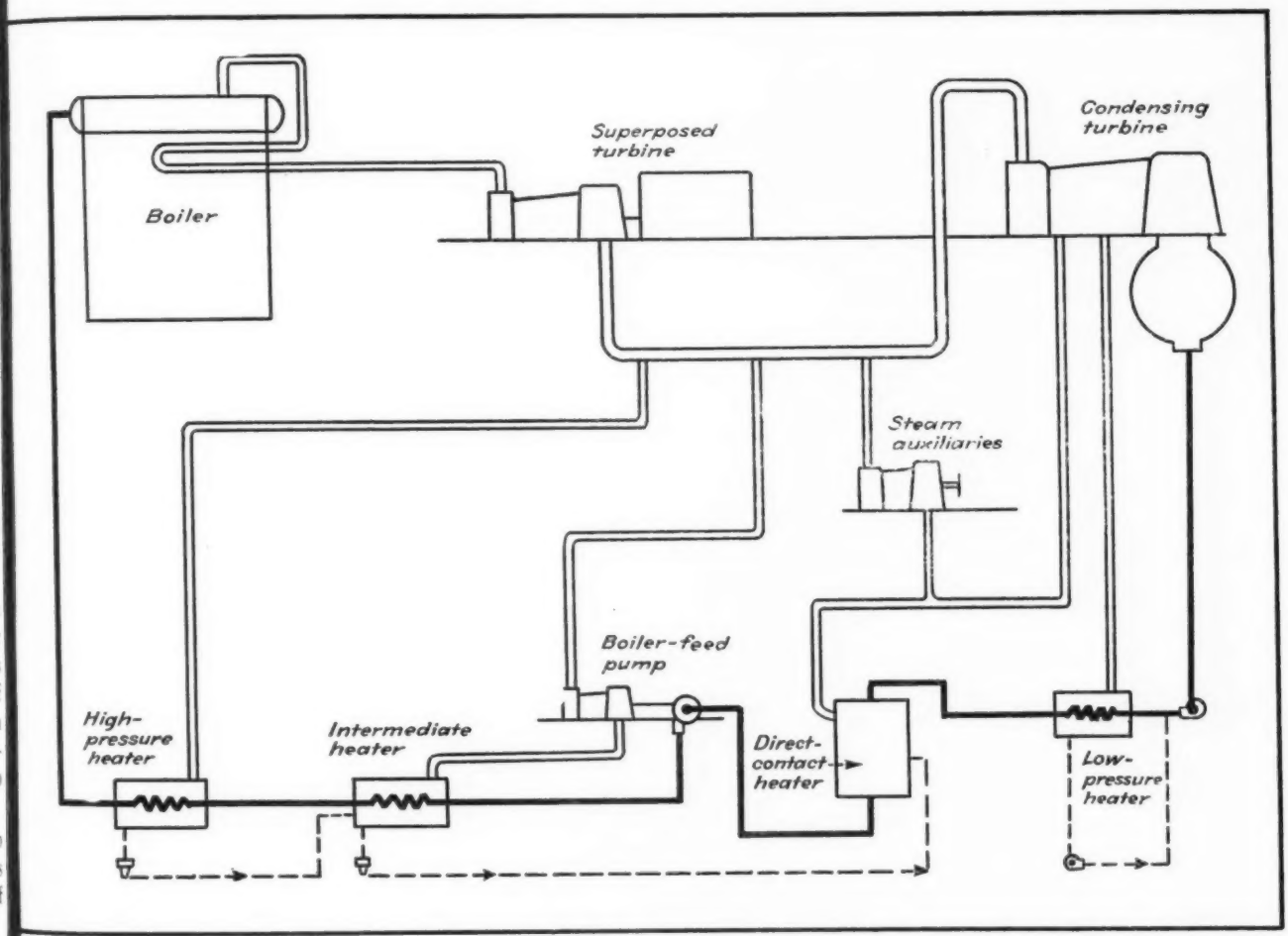


Fig. 1—Auxiliary-drive turbines can be arranged to exhaust at more than one point in the feedwater-heating system if total steam would raise feed temperature above that required for direct-contact heater

NOT SO MANY YEARS AGO steam furnished most of the auxiliary-drive power in boiler house and turbine room. Later, the small auxiliary turbine lost its preferred position in many condensing plants, because, with the increasing use of bleed steam for heating feedwater, the turbine became a nonessential part of the heat balance. In recent years, improvements have returned the turbine drive to favor, in competition with other drives on the basis of efficiency, reliability, freedom from supervision, adaptability, first cost, installation cost and auxiliary control apparatus required.

From a review of typical heat balances, we can draw some general conclusions as to where turbine-driven auxiliaries fit best. A first requisite is some satisfactory and efficient method of utilizing exhaust steam. In a condensing turbine installation, for example, steam auxiliaries, having several stages of extraction for feedheating, normally serve only as standby. With need for process or building heating steam at low pressure, turbine drive offers an ideal arrangement.

When a non-condensing turbine exhausts to process, an additional low-pressure stage of feedheating can be obtained from auxiliary turbine ex-

Fig. 2—Representative efficiency curve of a single-stage single-valve turbine at half and full speed shows the effect of hand-valve operation. Closing one or both hand valves is indicated

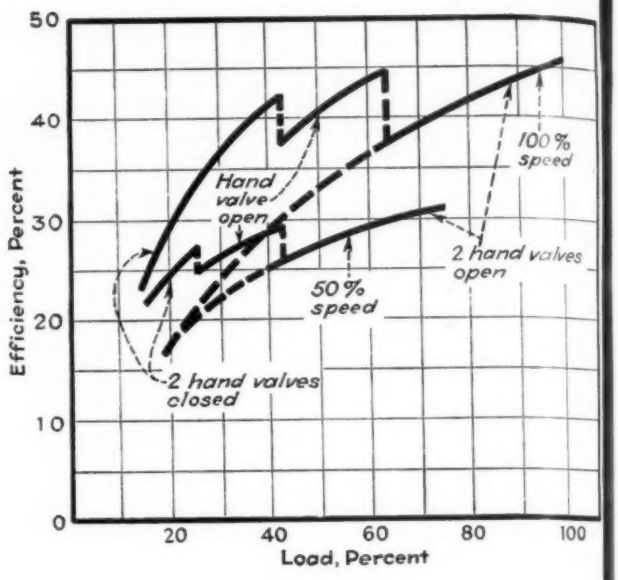
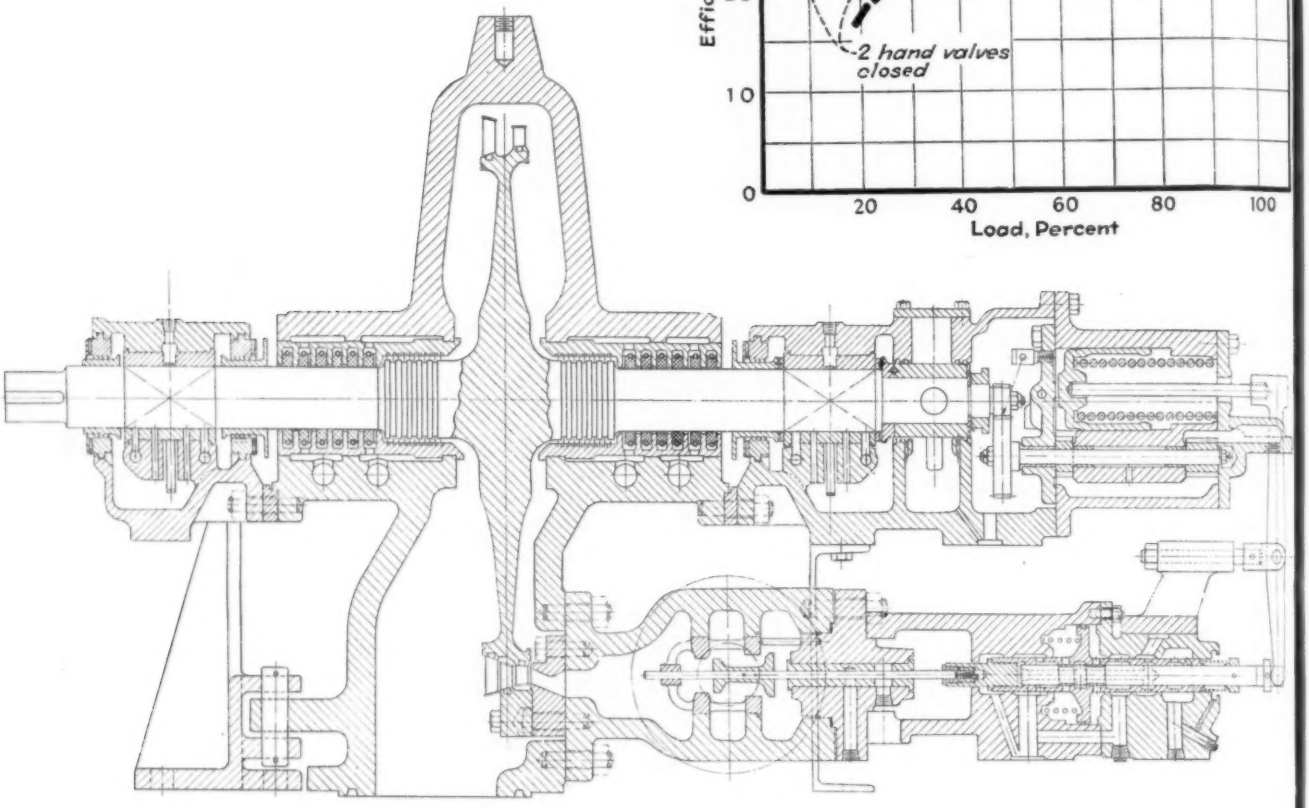


Fig. 3—Section through a typical heavy-duty single-stage turbine. This machine can be built for pressures up to 1500 psi and 300 psi backpressure for auxiliary-drive service



haust. In superposed plants where low-pressure turbines lack a sufficient number of extraction points, turbine drives for auxiliaries can make considerable improvement in cycle efficiency. A typical application of steam-turbine auxiliary drive to a superposed turbine cycle, Fig. 1, is only one of a wide variety of arrangements to suit individual cases.

Automatic-extraction turbines are subject to wide variation in bleed-point pressure below the automatic-extraction point, depending on steam demand and load. Steam-driven auxiliaries feeding low-pressure heaters can avoid this pressure variation and improve cycle efficiency.

The steam auxiliary not only fits into the heat balance in many cases, but also has wide application for standby drives. For instance, steam-driven auxiliary standby is particularly important during wartime emergencies, resulting from air raids, etc, in starting up a plant without electrical energy supply from interconnection.

Turbine auxiliary drives range in size from a few to some 2000 hp, depending on power-plant size and steam conditions. A complete line of auxiliary turbines supplies drives, ranging from the inexpensive single-stage drive for most small plants to the more expensive multi-stage units which large plants usually require.

Turbines in Small Plants

Single-stage single-valve turbines, such as a small plant can normally justify, are available for ratings up to some 1500 hp and for steam conditions up to 600 psi, 750 F and 50 psi backpressure. To meet the steady increase in steam pressure and temperature, a line of heavy-duty single-stage turbines has been developed during the past few years, available for steam conditions up to 1500 psi, 950 F and 300 psi backpressure. Fig. 3 shows a section through a typical heavy-duty single-stage turbine for these conditions.

Multi-stage turbines are normally used from 500 hp to the maximum required. In the range that overlaps the single-stage machine, they offer a more efficient drive as an offset to their higher first cost. The multi-stage turbine in Fig. 5 is used as a boiler-feed pump drive and exhausts to a deaerating heater; an intermediate-pressure heater is supplied from the bleed point on this turbine.

With several different types, designed to cover a range of capacity, speed, initial- and exhaust-steam conditions, turbine efficiency naturally varies widely. However, the drive cannot be judged satisfactorily by the efficiency of the auxiliary steam drive. The steam cycle

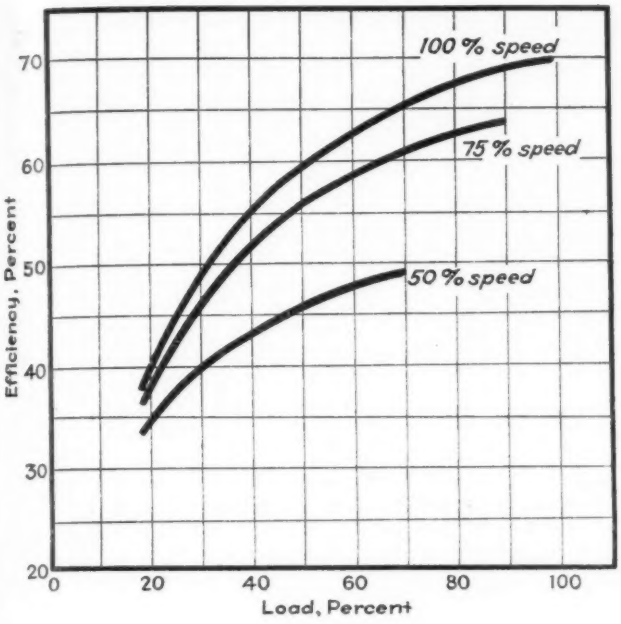
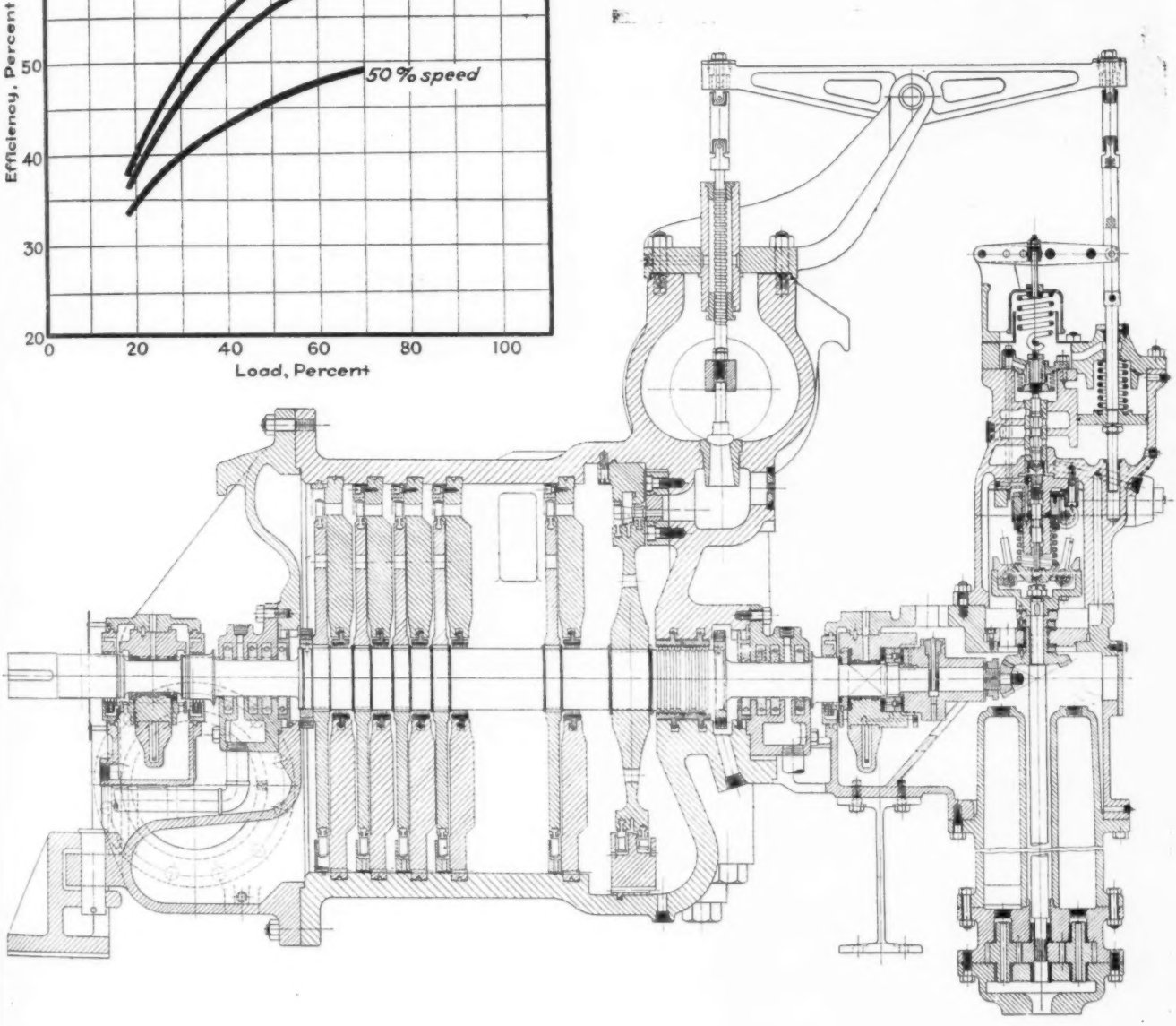


Fig. 4—Representative efficiency curve of a multi-valve multi-stage turbine plotted at three speeds—50, 75 and 100%

Fig. 5—Multi-stage turbine boiler-feed-pump drive exhausts to deaerating heater. Bleed point supplies intermediate heater



under consideration may find a 20%-efficient turbine the best selection in one case and a highly efficient turbine not good enough in another. Efficiency of the main unit and heat balance always enter into results. After all, the best possible auxiliary drive is a combination of main turbine and auxiliaries that evaluates out to the fewest dollars per net kwhr.

Fig. 2 is a representative efficiency curve of a single-stage single-valve turbine. Use of hand valves can make the efficiency curve fairly flat. Joining the peaks of the hand-valve points indicates approximate valve performance. Following the "2 hand valves open" curves downward, note that the dashed portion represents single-valve performance, which is the actual performance of the single-stage single-valve turbine when the hand valves are open. Effect of closing one or both hand valves is also illustrated. From this it is evident that hand valves, properly used, improve efficiency at partial loads considerably. Fig. 2 illustrates typical efficiency curves at both 100 and 50% speed.

Efficiency Curve

A representative efficiency curve of a multi-valve multi-stage turbine is shown in Fig. 4. For convenience, the curves are shown smooth, and represent average efficiency, with the jump at each valve point taken into account. Efficiencies are plotted for 50, 75 and 100% speed. Rate of decrease in efficiency at partial load is considerably less for a turbine when it is equipped with multi-valves than with a single valve. As on the multi-valve turbine, throttling is eliminated at full-valve points.

Since capacity of fan or pump varies with speed, it is possible to obtain capacity control by variable-speed drive, which eliminates the necessity for control by throttling the discharge of pumps and fans. This drive also saves power, reduces maintenance and gives accurate control.

THE OPERATING ENGINEER

George Edwards *Advisory Editor*

PRACTICAL AIDS · MAINTENANCE HINTS · QUESTIONS — ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

Skimp Pipe Size—For the Duration

Curb that tendency to order "one size larger to be safe" by using pipe and valves right up to their limit. For years Bill Maddock, mechanical engineer, has used these two check tables of economical size to give a quick first approximation to right size

TABLE OF ECONOMICAL PIPE SIZE

Pipe size, in.	*Flow, gpm*	*Head loss per 100 ft*	*Velocity, fps*	*Kwhr per 1000 hr*	*10-yr power cost, dollars*	*Pipe cost per 100 ft, dollars*	*Best selection for*		
							1000 hr in.-psi	*3000 hr in.-psi*	*8000 hr in.-psi*
1	50	256.0	18.6	4810	481.00	12.80	2-Ex hy	2½-Ex hy	2½-Ex hy
1½		28.4	7.87	535	53.50	20.60	2-150	2½-150	2½-150
2		9.9	5.11*	186	18.60	27.80			
2½		3.3	3.27*	62	6.20	44.00			
1½	100	102.0	15.74	3830	383.00	20.60	3-Ex hy	3-Ex hy	3-Ex hy
2		35.8	10.21	1350	135.00	27.80	3-150	3-150	3-150
2½		12.0	6.54	450	45.00	44.00			
3		4.96	4.54*	186	18.60	58.50			
2½	200	43.1	13.07	3300	330.00	44.00	4-Ex hy	6-Ex hy	6-Ex hy
3		17.8	9.08	1340	134.00	58.50	4-150	4-150	6-150
4		4.4	5.11*	330	33.00	82.00			
6		.61	2.27	46	4.60	143.00			
3	500	98.0	22.7	18,400	1840.00	58.50	6-Ex hy	8-Ex hy	8-Ex hy
4		24.0	12.77	4500	450.00	82.00	6-150	6-150	8-150
6		2.9	5.68*	545	54.50	143.00			
8		.82	3.19	154	15.40	216.00			
4	800	57.00		17,200	1720.00	82.00	8-Ex hy	10-Ex hy	10-Ex hy
6		7.96	9.08	2400	240.00	143.00	8-150	8-150	10-150
8		1.97	5.10*	590	59.00	216.00			
10		.66	3.26	196	19.60	308.00			
8	2000	10.71	12.78	8050	805.00	210.00	10-Ex hy		
10		3.59	8.16	2700	270.00	308.00	12-150	12-150	12-150
12		1.49	5.68*	1120	112.00	380.00			
14		.363	4.17	273	27.30				
14	5000	3.80	10.4	7100	710.00				
16		1.95	8.0	3650	365.00				
18		1.10	6.3	2060	206.00				
20		.68	5.1*	1270	127.00				
18	10,000	4.00	12.6	15,000	1500.00				
20		2.44	10.2	9200	920.00				
24		1.00	7.11	3760	376.00				
30		.337	4.56*	1270	127.00				
24	20,000	3.61	14.2	27,200	2720.00				
30		1.22	9.2	8780	878.00				
36		.504	6.3	3800	380.00				
42		.238	4.6*	1790	179.00				

Based on three arbitrary annual use rates at full flow, which in turn are based on power cost of one cent per kwhr; pipe cost of $150 per ton; pump efficiency — 50%; 10-yr operating period

* Economical velocity is about 5 fps

In this table of pipe size and the one of gate-valve size, on the opposite page, selections are based on a 10-yr economic life. Under present conditions, choose smaller sizes than those indicated. For pipe, long-term selections average about 5 ft per sec fluid velocity. For valves, sizes given lead to use of smaller sizes than those usually installed.

CHOOSING SIZE of pipe and valves usually starts an argument in normal times. Sure, it costs more to buy large pipe than small. But, equally true, it costs money to pump fluids through pipe, and the cost is less for large size than for small. And so we have to strike a balance.

In wartime, however, economic considerations are less important than saving critical materials. Temporarily, we should drop the long-term economy basis of selection and make designs on the "skimpy" side. In the same way that structural men arbitrarily set higher "safe" loading values for steel and timber, mechanical designers should use as little steel as possible. Here are some pointers on getting the most out of pipes and valves.

Before choosing "extra strong," look at the rupture pressures on pipe. And before selecting the next higher pressure valve, look at the pressures allowed for low-temperature service for flanges and valves. Use a smaller heat exchanger and let temperature difference be a little larger. Whenever you can couple two pumps to a single motor effectively, you save copper, switchgear and factory machine work. Avoid gadgets and ginger-bread as you would the plague.

For a number of years I have used the pipe and valve tables shown here. Under present conditions choose smaller sizes than those indicated for 10-yr life.

Advantages of Small Sizes

Shelf price of pipe and valves is not the only consideration as it accounts for only a part of the finished cost: *Smaller lines* are cheaper to weld and fewer men are needed to install a given length of pipe. Also, they are more easily arranged for operating convenience. *Smaller joints* are easier to make tight. Above all, *smaller valves* are easier to operate, keep tight and repair.

There is, of course, a limit to how small a line will do a given job of carrying a given flow. In normal times, the logical thing is to choose a pipe size and use reducers to make the valves match. With pipe and other materials at a premium under wartime conditions, fluid velocities as high as 15 ft per sec in pipe can be allowed.

On pump suctions it is still poor practice to use smaller pipe than the suction flange, but on the pump discharge there surely is no reason why the valves cannot be as small as the discharge flange even if the pipe size beyond the valves is to be increased.

Globe and other types of pressure-reducing valves cannot be compared for size on the basis of head loss. They are intended for throttling service where normally a large pressure drop occurs across the valve. In general, the smallest globe or automatic regulating valve that passes the maximum flow when wide open is the best buy. Seat and disk of the smallest valve operate with the most separation, wire drawing is reduced to a minimum and best regulation is obtained.

Choosing the smallest pipe size practicable pays an additional dividend often overlooked at the time of pipe selection. Smaller pipe loses less heat, whether bare or insulated. Under present conditions, calling for minimum insulation thickness for a given line, use of smaller pipe helps keep losses down.

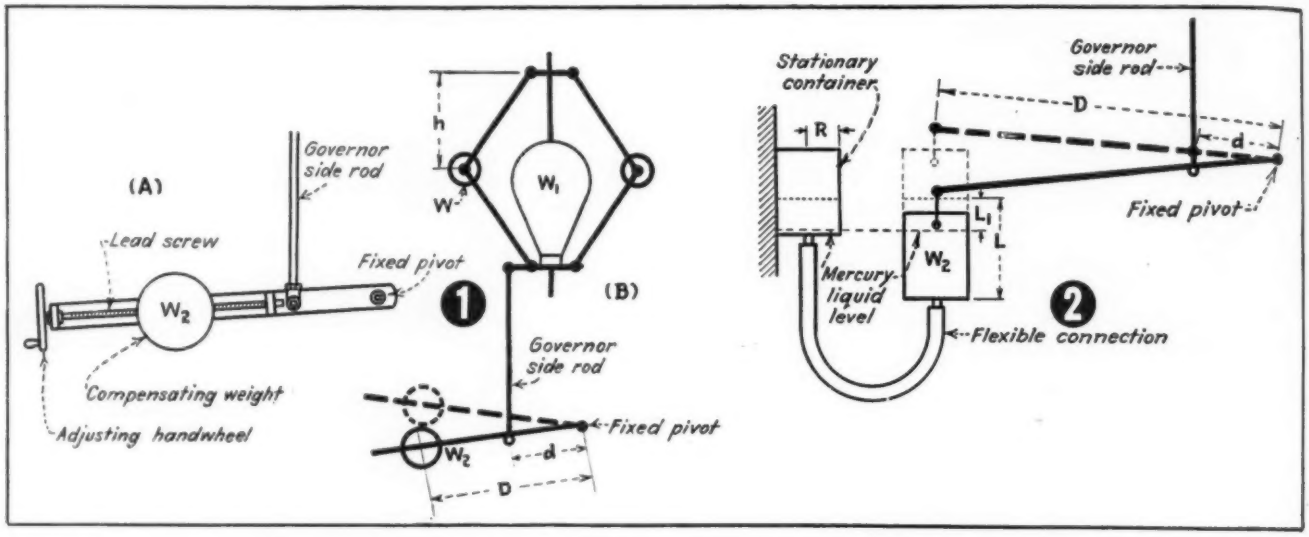
TABLE OF ECONOMICAL GATE-VALVE SIZE

Showing the least costly valve installation for the same basic assumptions as for the pipe, in the table on the opposite page, but at 50% of the manufacturers' list price for valves

Pipe, size, in.	*Flow, rpm*	*Equivalent length, ft*	*Loss per 100 ft.*	*Head loss in valve, ft*	*Kwhr per 1000 hr*	*10-yr power cost, dollars*	*Best selection for*		
							1000 hr in.-psi	*3000 hr in.-psi*	*8000 hr in.-psi*
1	100	....	....	....	....	....	1–1500	1–1500	1–1500
1¼		1.09	102.0	1.10	42.0	4.20	1– 900	1– 900	1– 900
2		1.49	36.0	.54	20.5	2.05	1– 600	1– 600	1– 600
2½		....	....	....	....	....	1– 300	1– 300	2– 300
3		2.4	4.96	.12	4.5	.45	2– 150	2– 150	2– 150
...	200	....	....	....	....	....	1–1500	1–1500	1–1500
2		1.49	129.0	1.92	145	14.50	1¼–900	2– 900	2– 900
2½		....	....	....	....	....	2– 600	2– 600	2– 600
3		2.4	17.8	.44	33	3.30	2– 300	3– 300	3– 300
4		3.4	4.4	.155	11.5	1.15	2– 150	3– 150	3– 150
...	500	....	....	....	....	....	2–1500	2–1500	3–1500
2½		....	....	....	....	....	2½– 900	3– 900	3– 900
3		2.4	98.0	2.40	450	45.00	3– 600	3– 600	4– 600
4		3.4	24.0	.82	153	15.30	3– 300	3– 300	4– 300
6		5.9	2.9	.170	32	3.20	3– 150	4– 150	6– 150
...	800	....	....	....	....	....	3–1500	4–1500	4–1500
...		....	....	....	....	....	4– 900	4– 900	4– 900
4		3.4	57.00	1.94	587	58.70	4– 600	4– 600	4– 600
6		5.7	7.96	.45	135	13.50	4– 300	6– 300	6– 300
8		8.1	1.97	.16	48	4.80	4– 150	6– 150	8– 150
6	2000	5.7	48.00	2.75	2070	207.00	6–1500	6–1500	6–1500
8		8.1	10.71	.87	655	65.50	6– 900	8– 900	8– 900
10		10.7	3.59	.39	294	29.40	6– 600	8– 600	8– 600
12		12.5	1.4	.172	130	13.00	8– 300	8– 300	10– 300
							8– 150	8– 150	10– 150
8	5000	8.1	64.0	5.20	9800	980.00	12– 150	12– 150	12– 150
10		10.7	20.5	2.15	4000	400.00			
12		12.5	7.8	.97	1820	182.00			
16		16.0	2.0	.32	600	6.00			
12	10,000	12.5	32.00	4.00	15,000	1500.00	12–1500	12–1500	
							12– 900	14– 900	
16		16.0	7.19	1.15	4300	430.00	12– 600	14– 600	16– 600
20		20.0	2.44	.48	1800	180.00	16– 300	16– 300	20– 300
24		25.0	1.00	.25	940	94.00	16– 150	16– 150	20– 150
16	20,000	16.0	16.00	2.55	19,000	1900.00			
20		20.0	10.00	2.00	15,000	1500.00	14– 900		
24		25.0	3.61	.90	6750	675.00	14– 600	16– 600	24– 600
30		30.0	1.2	.36	2700	270.00	16– 300	16– 300	24– 300
							16– 150	24– 150	30– 150

A GOVERNOR TO ARGUE ABOUT

E MacDermod, of Melrose, Mass., thinks some of our war-weary power engineers might like to debate this governor idea for a change. Comment is invited, but to save space and reader time, the editors will give preference to brief remarks



"What's wrong about compensating the governor with variable mercury weight to bring engine to fixed speed?"

WHILE MY ASSOCIATES at the Naval Training School, at Wentworth Institute, are not 20th-century Galileos or Newtons, neither are they descendants of the Juke family. At a recent bull session, the result of uncorking a brain storm I had many years ago when operating a Corliss engine was most gratifying. A near riot ensued and one department head was invited back of the power house by his assistant. Maybe POWER readers can straighten the matter out.

Since the regulation of this Corliss engine's governor was not all it could have been, result was considerable variation in frequency with changing load. To keep the frequency constant, we moved the compensating weight on the governor lever either in or out by turning the handwheel attached to a leadscrew moving the weight, thus speeding or slowing the engine.

After a few months of irksome handwheel turning I began to devote some thought to making the weight movement automatic so I could spend more time poring over *Captain Billy's Whizbang*.

The problem of adding more weight to the governor lever as it rose would have been easy, but adding more weight as it descended was another proposition. Finally, however, I hit on the idea sketched in Fig. 2.

From the end of the governor lever is suspended a container connected by flexible tubing to a stationary mercury container attached to the governor post or other convenient point. *Plane* of the mercury in each container remains constant regardless of the position of the container.

On the other hand, actual mercury loading of the movable container is proportionate to its movement; if it rises it loses mercury and therefore weighs less; if it falls it gains mercury and therefore weighs more. The net result is the same as previously accomplished by moving the weight along the governor lever, and should maintain constant engine speed.

The amount of mercury that should be added or substracted from W_2 to correspond with the lever movement, and also the proportions of the containers, may be determined by reducing the following formula for the Porter governor:

$$h = 2(35200/N^2) \times (W + W_1)/W$$

In this formula h is distance shown on sketch B, Fig. 1; W = Weight of one ball; W_1 = Equivalent dead weight $= W_1 + W_2D/d$, and N = Rpm of governor

Since the engine and governor speed are assumed constant, $2 \times 35200/N^2 = \text{constant} = K$. The formula then reduces to:

$$W_2 = (hW/K - W - W_1)\ d/D$$

For a given setup, all the quantities on the right side of this equation except h, are known and constant, so the equation is easily solved to determine the correct weight of mercury in W_2 for various values of h.

Note that the weight of mercury in W_2 is in direct proportion to the depression of the moving container, and can readily be computed from an assumed diameter of the container.

Of course, there is more than a remote possibility that such an arrangement would cause the governor to be unstable and yaw over a wide range. However, most governors have dashpots or other damping arrangements—and who am I to object to the same on my equilibriated governor lever? Or maybe I should say "inebriated."

All this is a screwball argument, but a freak proposition often does more to revive one's waning knowledge of algebra, mechanics, physics, etc than a dozen legitimate problems.

REFRIGERATION NOTEBOOK — 4

When Do Booster Machines Send Power Costs Down?

By TERRY MITCHELL, ME, *Frick Company*

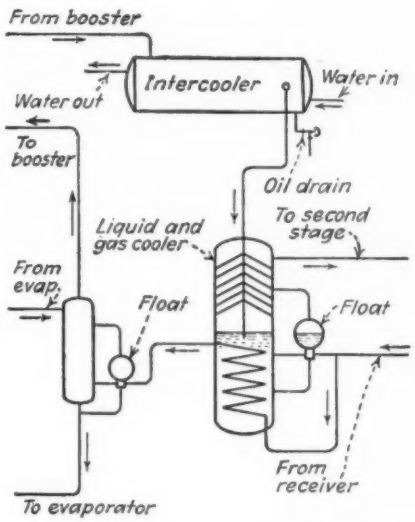
BOOSTER MACHINES are effective in refrigerating work for the same basic reasons that 2- and 3-stage pumps and air compressors are in power plants. When ammonia gas must be compressed more than seven times its original pressure, it is usually worth while to compress it in stages. This is just as true when the machines must work against an exceptionally high head pressure as when they are contending with the low suction pressures that go with low temperatures and that often run into ten or twenty inches of vacuum. You may use three and even four stages for holding temperatures of 70 to 100 F below zero.

Gas Must Be Cooled

In any system of this kind the discharge gas from each stage, or booster, must be cooled enough to remove most of the heat of compression before the gas enters the next stage. If water at a temperature below that of the gas is available, part of the cooling may be done in a shell-and-tube intercooler. The remaining part of the heat, or all the heat when low-temperature water is not available, is removed in a flash-type intercooler. The latter, without series connected shell-and-tube intercoolers, is shown in the diagram, illustrating how the flash cooler also precools the liquid ammonia going to the low-temperature coils. Proper design of these coolers and their control is as vital as the selection of the right size of booster. Shell and tube unit at right.

In a 2-stage system, gas from the booster usually enters the high-stage compressor at about 20 psi gage. As a rule, sizes of booster and high-stage compressors are proportioned to give equal horsepower loading and equal compression ratios. Sometimes you can make as much as 20% saving in power, or even more, with only one booster. First cost of a low-temperature plant can sometimes be lowered 20% or more by taking advantage of booster compression.

In an emergency, a booster machine not equipped with jacketed cylinders can be made to carry temporary overloads if a rain of water is sprayed over the cylinder heads; you can often lower the temperature of the discharge gas as much as 100 deg by this method. Newer booster machines, especially the big ones, are arranged to be cooled with either water or direct-expansion ammonia. If you use water, take proper precautions to prevent its freezing.

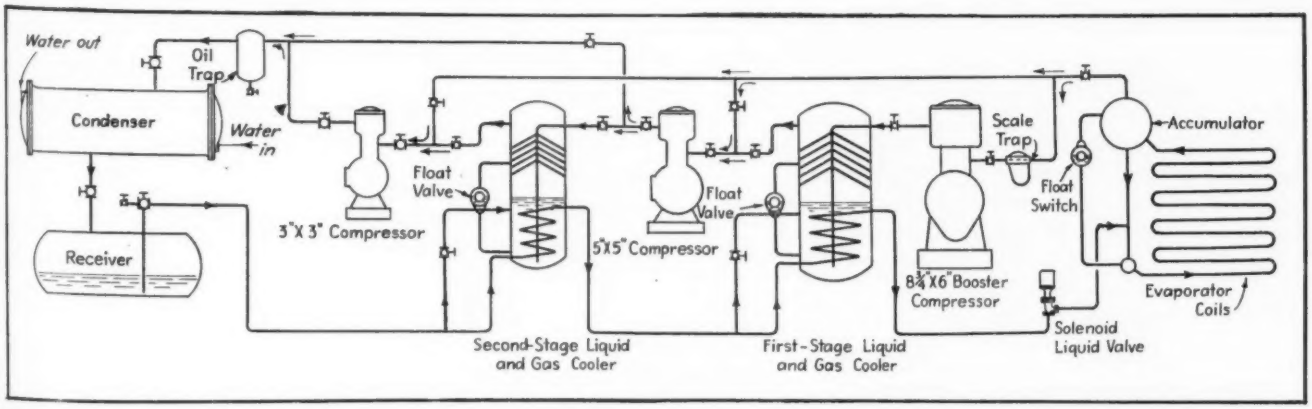


Driving Arrangement

The favorite way to drive large boosters is to connect a synchronous motor between the low-pressure machine and the second-stage unit. A 15x10-in. booster makes a good team with a 9x9-in. enclosed compressor. Both machines have two single-acting cylinders, and generally operate at 360 rpm. When separate drives are used, the high-pressure machines must always be running with suction valve wide open before the booster is started.

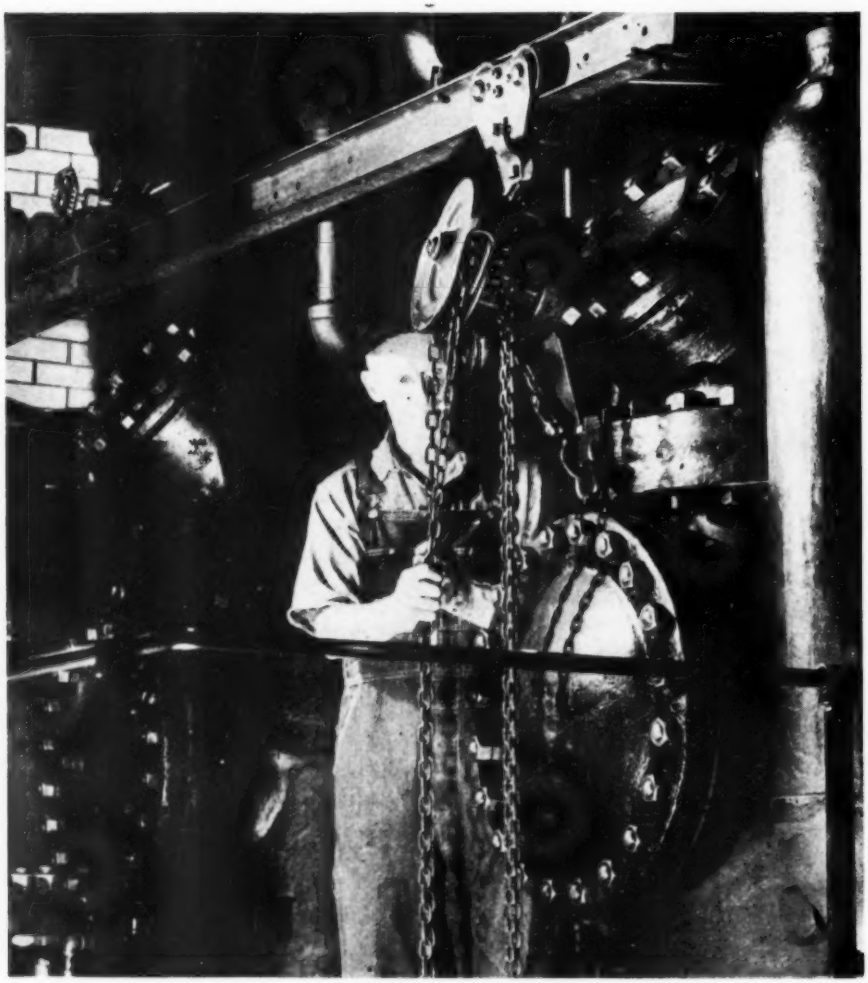
Adjust the liquid feed to the low-temperature evaporator to keep frost from covering the booster cylinders. Always avoid "wet compression" as it wastes power: Because of the low-suction pressure under which they operate, booster machines are very sensitive to the effect of liquid ammonia carried over from the evaporator. Unless you know just how to manage it, never use a booster for pumping an air pressure.

It is now possible to build a 4-stage booster system with such accurate controls that by pushing any one of ten buttons you can obtain any one of ten temperatures, in as many steps ranging from minus 70 to plus 70 F.



Refrigeration circuit arranged for single-stage (parallel) operation, using two compressors, two-stage or three-stage operation. Flash-type intercoolers serve to cool refrigerant as well as cooling the gas between compression stages

PRACTICAL AIDS TO OPERATION



Hoist on Trolley Handles Cylinder Heads

ONE OF THE PROBLEMS in every plant is the handling of heavy parts of equipment, particularly in these times when there is a shortage of trained personnel. A trolley hung from an I-beam for a chain hoist frequently proves a satisfactory solution, as it did on one of our large pumps. This unit is a heavy, triplex, steam-driven reciprocating flywheel type.

To permit easy handling of the water-end cylinder heads we supported an I-beam from the pump above the cylinder heads and tapped an eye-bolt into the top of each head. A trolley on the I-beam allows us to move a chain hoist over each cylinder head and hook into the eyebolt, as in the photo.

When the nuts have been taken off the studs the head can be easily taken off and moved to one side to permit packing the piston or other work in the cylinder. To replace the head it is hoisted to line up with its studs and pushed home.

New York, N. Y.

THOMAS WOOD
Chief Engineer,
Mutual Life Insurance Co

Using Pipe Cutter on Threaded Section

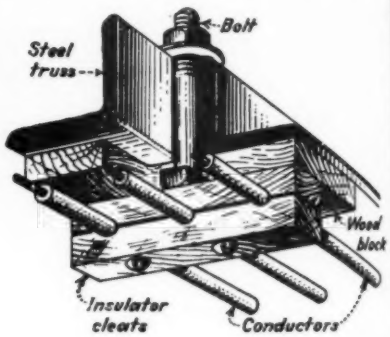
CUTTING OFF the damaged ends of previously threaded pipe often requires placing the cutting wheels of hand-operated pipe cutters directly in some part of the threaded section in order to retain sufficient length of pipe. Cutting off a portion of the thread in this manner is difficult to do accurately, since the cutting wheels will tend to follow the thread grooves. If the pipe cutter is set in such a way and turned in a direction to cut *against* the threads, not only will time be saved but also improvement in workmanship will result.

When cutting off a pipe having a right-hand thread the cutter should be turned to the left when the cutter is applied on top of the pipe. The cutter must also be held at right angles to the pipe with pressure exerted directly against the threads. If this is not done and the cutter wheels are parallel to the spirals, not only will the job be poorly done but there is danger of disturbing the alignment of the cutter.

Stanton, Va. S H COLEMAN

Supports Power Line on Roof Truss

WE HAD TO CARRY a 3-phase power line along the under side of a steel roof truss and did the job as shown in the figure. After cutting 2-x-4-in. lumber of suitable length to support the cable insula-



tors, we drilled a hole in the center of each piece for a ⅜-in. bolt and countersunk the hole for the bolt head. These pieces we attached to the bottom of the truss with a bolt run up between the two angles. When this was done it was easy to support the power cables on insulators from the wooden pieces, as shown.

Detroit, Mich. L R CARRY

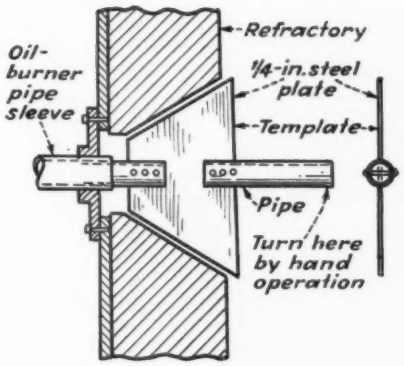
Template Forms Oil-Burner Refractory Cones

WE BURN OIL in our boiler plant and occasionally the refractory cones around the burners have to be repaired

and reformed. Repairs are made by cleaning out the sections when the refractories are damaged and then driving a plastic refractory into the cavities. To shape the cones we made a template of ¼-in. steel plate, with the same taper as in the cone.

From a pipe of an outside diameter that would go inside the burner sleeve, we cut two pieces. In one end of each piece of pipe we cut a ¼-in. slot about 4 in. long, placed the template in these slots and securely held it there with rivets through the pipe, as in the diagram.

To use the template to form a cone, one pipe section is put in the burner sleeve to act as a guide while with the other pipe we rotate the template until we obtain a true surface on the



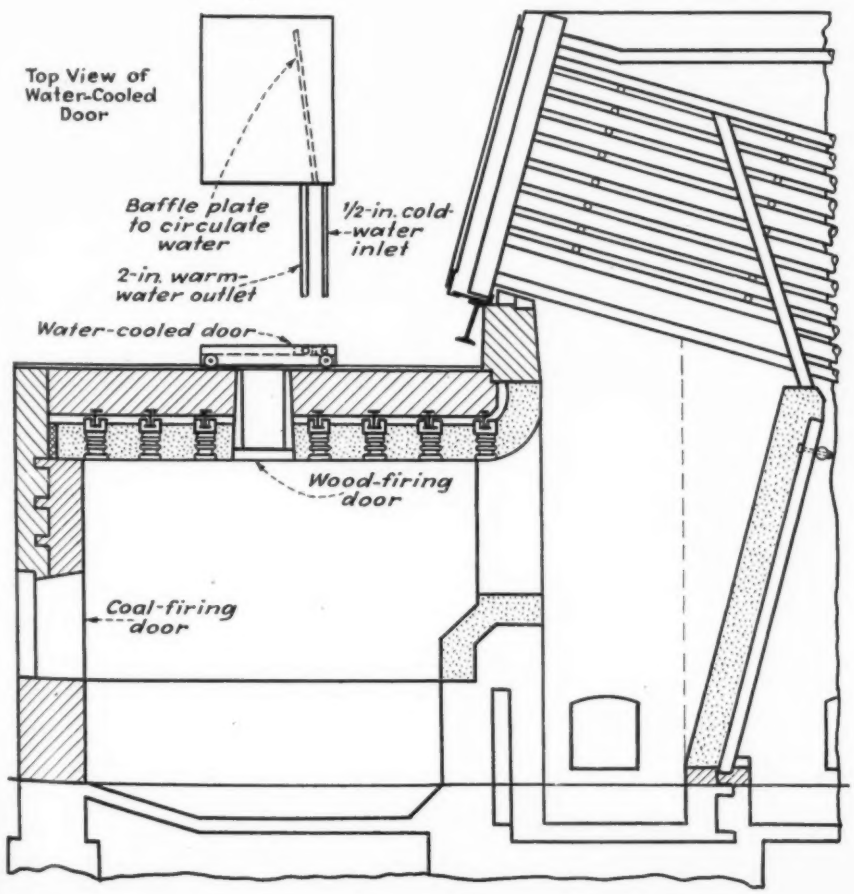
refractory. With the template it is always possible for us to work the refractory cones to their original form each time they are repaired or replacements are made.

Fairview, N. J M N GOZDENOVICH

Whipping a Hot Job on a Dutch Oven

IN A WOODWORKING PLANT having considerable wood refuse to burn in its boilers we installed a Dutch oven on each of the two 3000-sq-ft boiler furnaces. Sawdust and shavings are collected and burned as made, being spouted through the top of the furnace at an angle of 45 deg and practically burned in suspension. Coal is fired by hand on flat grates below, and larger wood waste fired through a "glory hole" in the furnace top. Safety, as well as economy in operation, required that the 16x58-in. firing hole be covered between firing periods.

First, a heavy cast-iron frame door, hinged to open up by hand and lined with heavy refractory was installed.



The heavy jar of closing this door when hot soon ruined its linings. To get away from this difficulty heavy steel air-ventilated doors were tried. About 50% of the metal in the doors was drilled out in the hope that air drawing through the holes would keep the remainder passably cool. However, they warped badly and proved an utter failure. Steel, for lightness, lined with asbestos board, fared no better, as did steel lined with 85% magnesia pipe covering.

Finally the master mechanic hit upon the idea of a water-cooled cover mounted on wheels on a track. This solved our problem with very little cost above that for our previous attempts.

This door is a rectangular watertight box 4 in. high, 30x60 in. in plan, mounted on 4-in. stock wheels placed under the box and rolling on an angle-iron track. A skirt sheet, hung as low as possible all around the outside of the box, cuts down excess overfire air to the minimum. Water flows through half-inch pipe into the door near one corner. A baffle forces the water to travel the door length and return before discharging through 2-in. pipe to the boiler-feed system. A hose connection to the half-inch pipe and a telescope device on the 2-in. pipe permits free travel of the door.

It has been found that very little water is required to maintain a temperature so low that the hand can be held comfortably on the door, under firing conditions that previously kept earlier doors red hot and caused their rapid failure.

On the second door we cut down the water space height and used higher vee grooved wheels run on the backs of 3-in. angles. This door is lighter, runs easier, and is much easier on the fire room crew than the first one. Top of the box is removable to facilitate cleaning when necessary.

Cincinnati, Ohio H B MCDERMID

Check-Valve Leakage Wrecks Pump Motors

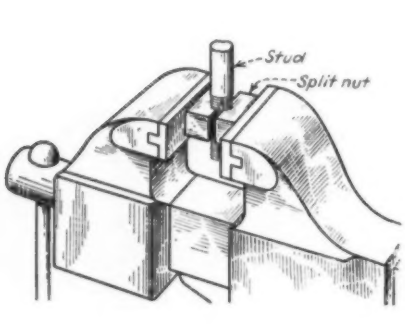
THE IMPORTANCE OF KEEPING PUMP discharge check valves in good repair and operating condition was emphasized by accidental destruction under similar circumstances of two large motors over a period of about three years. Each motor was rated 100 hp, 3600 rpm, 3 phase, 60 cycles, 2200 volts, driving a hot oil pump. In both instances, after an unobserved power shutoff caused by tripping of overload relays in the motor starter, fluid flow

reversed through the pump. Check valves had become so carbonized as to prevent their closing tightly, permitting a large flow back through them. Apparently the steam-turbine-driven auxiliary pumps automatically picked up the load. Since there already was a high head against the discharge side of the motor-driven pumps the rotors began to rotate with increasing speed in a reverse direction.

Plant operators noticed the sound of the pumps increasing in speed and were attempting to stop them when centrifugal force burst the motor rotors. Parts of the broken rotors were driven through the stator windings with sufficient force to travel through windows and about 50 ft, after breaking through the double cast-iron housings of the motors designed for use in hazardous gas-filled areas. Fortunately no explosion or fire resulted and no one was injured seriously.

The manner in which the windings were torn and the shape of the fragments remaining in the motor and around the broken housings gave definite evidence of reverse rotation. Further investigation developed that the overload relays had tripped in both instances and the lack of burning in the windings verified indications that no current was flowing in the coils when rupture occurred. Both motors were reduced to scrap and the rotor rings to which the bars were brazed were so distorted that the bars appeared to have been "turned inside out" by the force which caused their destruction.

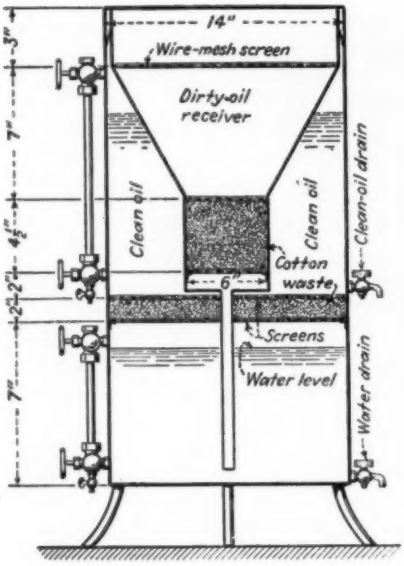
New York, N. Y. R C LARKINS

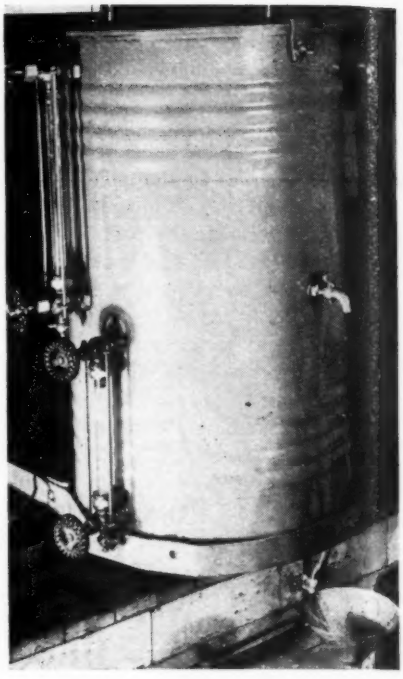


Half Nuts Better Than Whole Ones

EVERY ENGINEER has on various occasions tried to hold the threaded end of a stud or bolt in a vise without injuring it. To eliminate this problem in our shop, I cut nuts in half for the different standard-sized bolts. These nuts are kept in a handy box and, when a bolt or stud has to be held by the thread in a vise, it is clamped between two halves of the right-sized nut as in the figure. With this arrangement, any amount of pressure can be put on the thread without danger of injuring it.

Great Neck, N. Y. S M ELONKA





Homemade Filter Saves Waste Oil

A LARGE PART of the used oil in the power plant of the Washington Life Building, New York City, is piped back to a filter where water and dirt are removed. It is then pumped up to the gravity tank from which it flows to the engine bearings. Besides the oil that circulates continuously, there is a considerable quantity used only once. Originally this oil was thrown away after it had passed through the bearings, as it contained considerable water and dirt and was not suitable for reuse in that condition.

To save this oil I made the filter shown in the photo and diagram. About 7 in. from the bottom of the filter are two 20-gage perforated sheet-metal plates with 2 in. of cotton waste between them. The dirty-oil receiver in the top of the filter has a wire-mesh screen near its top. This receiver is packed with cotton waste between two perforated plates near its bottom and has a pipe that extends down almost to the bottom of the container—see diagram.

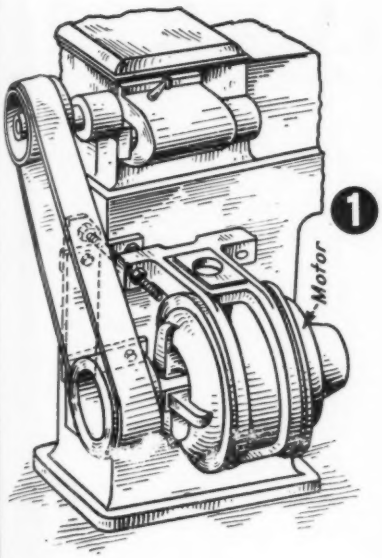
Waste oil poured into the dirty-oil receiver gradually settles down through the thick layer of waste into the bottom of the filter where the water settles out. From here the clean oil rises up into the top compartment around the dirty-oil receiver. Any dirt that may get through the waste in the dirty-oil receiver lodges in the second layer of waste. Gage glasses on the side of the filter indicate the height of clean oil and water. These are drawn off as they accumulate and the clean oil returned to use.

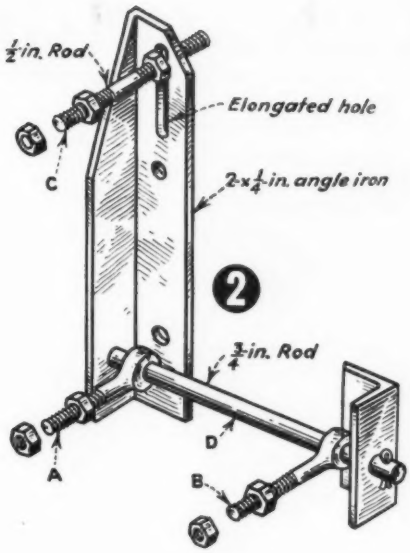
New York, N. Y. ALBERT FISCHER

Lathe Drives Pipe Threader

WE HAD A LOT of 2-in. and smaller pipe to thread in our plant and could not secure a pipe-threading machine so we pressed a small lathe into service. We stripped the lathe of everything but the chuck and its driving mechanism. We then mounted a pipe vise on the free end of the lathe at a level where a 2-in. pipe in the vise would just about center on the middle of the chuck.

A driving head with two pins was made of the shape shown at *A* in the figure. In the center of this head we welded a section of $\frac{1}{8}$-in. rod. One end of this rod extended into the pipe being threaded to act as a guide spindle for the driving head. On the other end of the rod we welded part of a universal joint, obtained from an old automobile. At the chuck we welded one half of another universal joint to a rod to go into the chuck to drive the threader.





Motor Mounted on Vertical Adjustable Base

WE INSTALLED SOME MACHINES recently that have their motors mounted on them in a way that is worthy of attention. This mounting is shown in Fig. 1. The base of the motor is almost vertical and in this position the two bottom feet are locked to the threaded eyebolts *A* and *B*. Adjustable rod *C* connected to the top left-hand foot of the motor. This connection positions the motor to put proper tension in the belt used to connect the motor to its load. The way the motor is overhung it has a tendency to swing down on the eyebolts around rod *D*, but is prevented by adjustable rod *C*.

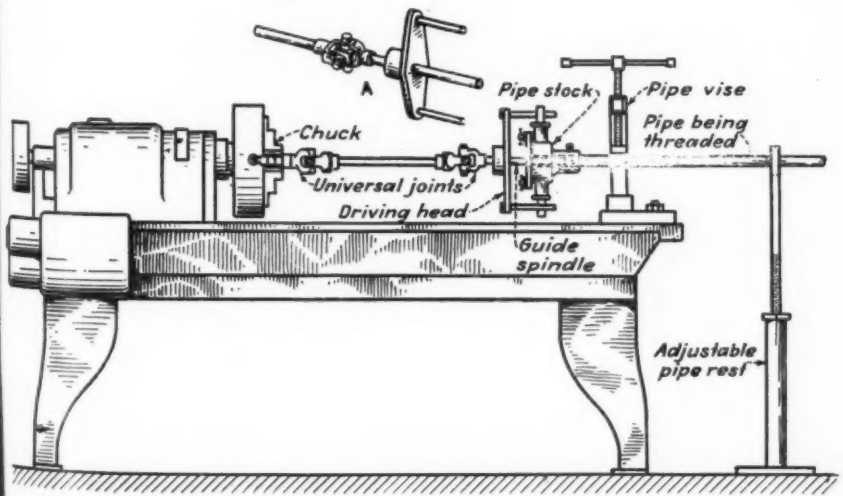
Fig. 2 shows how the motor is mounted on the machine. Even though this is not an automatic tension base it provides easy adjustment of the belt tension and is fairly compact. Production operations prevented mounting the motor above the machine and we did not want it on the floor. This type of mounting solved our problem.

Englewood, N. J. R BOETTINGER

The free halves of the two universal joints we welded to a drive shaft long enough to reach to drive head.

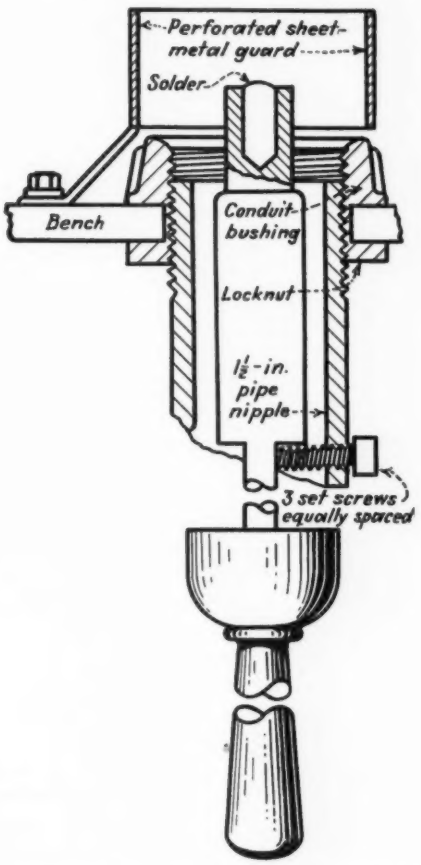
The complete assembly is shown in the figure. Sleeves were also made to fit over the guide spindle that would fit inside 1¼-, 1½- and 2-in. pipe to center the drive head. The long handles were removed from the stock and short one substituted that would clear the lathe when the stock rotated. To thread pipe, we placed the pipe in the die, pushed the end of the pipe over the drive spindle and then closed the vise. The drive head was then given a turn or two by hand to start the die on the pipe. Then the lathe was started to run the thread on the desired length.

Ironton, O. GEORGE T WHITE



Soldering Iron Makes Efficient Soldering Pot

ADAPTING STANDARD ELECTRIC soldering irons to serve as small soldering pots has facilitated the production of small instrument-type motors in one of General Electric's Works. Because they present only a small area for oxidation, the irons are saving materials.



Developed by R H Bainbridge, a foreman, the solder pot is easily built. A standard medium-size soldering iron tip is faced off flat and drilled with a 0.25-in. diameter hole, 0.75 in. deep. The iron is then mounted vertically in a hole in the bench so that the tip projects about 2 in. above the top. Mounting is made permanent with a standard pipe nipple locked from the top with an electrician's conduit bushing and from the bottom with an electrician's lock nut, as in the figure. The iron is held in the bushing by three setscrews which clamp the body of the iron proper.

A perforated sheet-metal guard encircles the exposed tip of the iron and permits free circulation of air to prevent overheating the solder.

READERS' PROBLEMS

Questions from Our Readers

Can Water Tank Be Painted?

Question 1

THE WATER SUPPLY *for our plant sprinkler system comes from a 100,000-gal elevated storage tank through an underground steel pipe. A leak must have developed in this line because originally we added water only once a week to keep the tank filled and now we must add this water daily. Is there any method we can use to find this leak without uncovering the underground line?*

We also have a filtered-water storage tank situated on a hill considerably higher than the plant. The filling line goes from the plant to the tank and also feeds plant service as well as several homes near the tank. Normal pressure ranges from 40 psi at the dwellings to 125 psi in the plant. Pumps run intermittently to keep the tank filled.

The tank is badly corroded and to do the necessary cleaning and painting will require the tank remaining empty for at least one week. Water service must be maintained and the pump shut-off pressure is too high to run directly on the main without the tank in service. This pressure is considerably higher than release pressure of the many hot water relief valves. Pump motors operate at constant speed. Can POWER *readers suggest some way of running the pumps on this line with the storage tank out of service?*—HS

Pump Pounds After Quiet Operation

Question 2

WE HAVE A NEW *simplex double-acting steam-driven boiler-feed pump that has given us a lot of trouble. Water temperature is around 205 F and discharge pressure 175 psi. The water piston is packed with formed rings of a fabric packing commonly used for the purpose. Before putting the packing on the piston we soak it in hot water to soften and expand it. The packing has scored the bronze cylinder liner and once part of the packing was torn off the piston and got into the feed lines. We thought that the packing may have swelled and become too tight in the cylinder. Working on this theory, we increased the space between the packing flanges on the piston until there was lost motion between the packing and the piston, without correcting the trouble. Faces of the bronze valves have also started to pit. Chemists have tested the feedwater and report that it contains nothing that would attack the valves or liners. At times the pump pounds so badly that we have to shut it down to prevent the piping joints from loosening. These pounding periods start after several hours of quiet operation. There is a total positive static suction head on the pump of 15 feet, and the suction line is short, direct and large for this size pump. Can* POWER *readers tell us what causes this liner scoring and the serious pounding?*—AGF

Answers to May Question 1

How Do You Test Fuses?

The Question

WE WOULD LIKE to have the opinion of POWER *readers as to the best methods of testing different-sized fuses in electrical circuits.*

Our main distribution is at 13,000 v, being stepped down to 2300, 440 and 220/110 v for power and lighting. With so many different-sized fuses, is it possible to use the same device when testing all of these fuses?

When a bad fuse is suspected in a polyphase motor circuit, can the fuse be tested in place or must it be transferred to a separate potential?

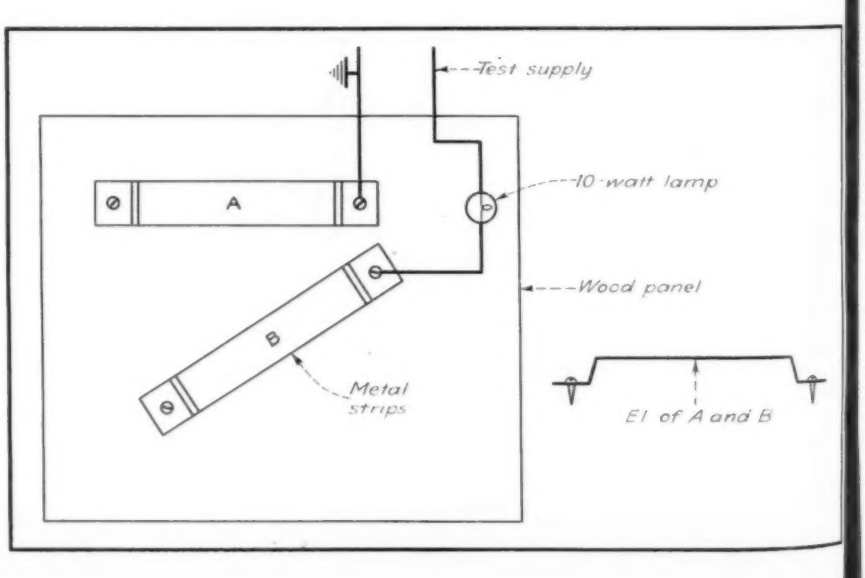
I understand that the ordinary bell and battery or lamp arrangement might blow an otherwise good 13,000-v potential transformer fuse. If this is the case, what method can we use?

On lighting cabinets with one side grounded, is the test dependable when the probes are placed on the cabinet and live circuit? What methods are most dependable?—RJ

Convenient Test Board

RJ CAN TEST his fuses with the home-made test board shown in the sketch. At the right hand side the copper or brass strips should be close enough to test 30-amp cartridge fuses by touching the ferrule of one end to bar *A* and the other ferrule to bar *B*. If the fuse is good the small bulb will light. If the fuse is blown, light remains out. All various size fuses may be tested on this board, the distance the bars spread should be enough for all lengths of fuses used in the plant. The current used in this test will, of course, not be enough to blow any fuse over 0.10 amperes.

When any doubt exists as to the condition of fuses in any circuit, all fuses should be taken out and replaced by new tested fuses. The ones taken out



may then be checked in the shop. It does not pay to try to test fuses in place. A complete set of spares should be carried in the electrical stores.

Where a grounded neutral system is used, providing all hardware, conduit, and cabinets are grounded, a test from the load side of the fuse to the cabinet frame will indicate correctly the condition of the fuse. This is on lighting circuits or on 4-wire 3-phase power circuits where the neutral is grounded. The 3-phase 3-wire ungrounded circuits will not give a dependable test for open fuses by testing from line to ground.

Collingwood, Ont. W M PRENTICE

Use Tong-Type Ammeter

METHODS OF DETECTING and locating open fuses depend largely upon local conditions and circumstances, but fall largely into two distinct divisions: (1) tests in energized circuits, and (2) tests in de-energized circuits.

Open fuses in live circuits with potentials below 550 volts may be detected by means of a voltmeter used to indicate a difference of potential across the fuse-mounting clips. At higher potentials, this method introduces some degree of hazard depending upon the potential and the type of voltmeter equipment available. In polyphase-motor circuits the voltmeter test may be supplemented by a current check in each phase.

A tong-type ammeter is readily adaptable to both the potential-difference and the current test method. Where test jacks are provided in either the motor or the control circuit, they will permit a quick check of current flow to each terminal. An ammeter should not, under any circumstances, be connected in such a manner as to bridge a fuse.

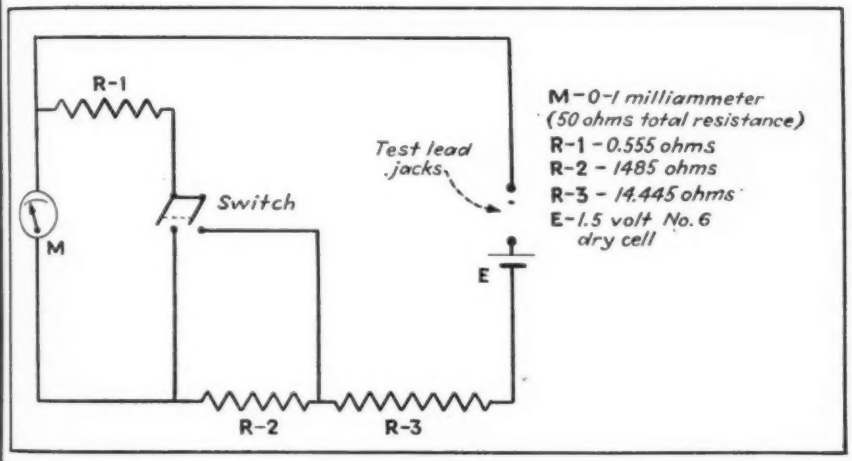
In testing fuses in circuits preceded by an open safety switch or in checking fuses removed from their clips a simple ohmmeter or continuity checker will be entirely adequate. A device suitable for testing instrument as well as power fuses is shown in the sketch.

With the toggle switch closed, maximum current through the test leads is 0.1 amp and the resistance indicated by a mid-scale meter reading, 15 ohms. With the toggle switch open, maximum current through the test leads is 0.001 amp and the resistance indicated by a mid-scale reading is 1500 ohms. In either position the full-scale reading is zero ohms.

The meter may be readily calibrated, either from a standard resistance box or mathematically, so as to be useful in checking circuit or insulation resistance.

By adding more batteries and, of course, series resistors to adjust the current to .001 amp when the test loads are shorted, the meter may be used to indicate resistances of several megohms.

Huntingdon, Pa. R G CORBIN



Use 2-Watt Neon Lamp

IF A FUSE on a polyphase motor blows while the motor is running, testing the fuses in the circuit will not show up the defective fuse, because of the voltage induced in the idle phase.

The use of a 2-watt neon lamp in the test board instead of the ordinary incandescent lamp will eliminate any possibility of fuse being destroyed by the test circuit current.

If the conduit system is properly installed the cabinet will provide a ground for testing fuses on grounded neutral lighting circuits.

A most useful instrument for fuse and other circuit testing, when they are isolated from supply source, is a self-contained pocket size ohmmeter, such as a radio service man uses. This instrument can be obtained with both ohms and voltage scales. Both ac and dc ranges are usually provided.

Hamilton, Ont. J A COULDEN

Remove High-Voltage Fuses From Their Clips

WITH PROPER CARE the same equipment may be used to test all fuses, except the energized high-voltage fuses. A small lamp in series will not blow the 13-kv fuses if used for testing, but the lamp should be small and of course the 13- and 2.3-kv fuses should be removed from the circuit before being tested. A bad fuse in a motor circuit may be tested in place with a test lamp or a tester of the voltage of the circuit. A good fuse will give no indication if tested from top to bottom ferrule if the motor is still running (single phase) while a blown fuse will indicate full voltage. Single-phase ac and dc circuits can be tested from top of one fuse (the hot side) to bottom of another, in place, and the test indication will be no voltage if blown and full voltage if good.

Tests on lighting cabinets for blown fuses are as reliable as any other when the cabinet is grounded if the test is made so that the current passes through the fuse, or would if the fuse were good. It is always best to start testing with equipment that you know is good for the highest voltage you have. Never run the risk of putting a 220-volt test lamp or device on a 440-volt circuit, or a 110-volt test on 220 volts. This is obvious but often overlooked.

Carlsbad, N. M. E A ROBERTS

3-Phase Circuits Are Tricky

FUSES FOR HIGH VOLTAGE potential transformers usually consist of wire of very low curent-carrying capacity. Care must be exercised so as not to pass too much current through them when testing. This can occur while using a bell and battery test set because while the voltage is low, the current, compared to carrying capacity of the high-voltage fuse, is high. A small neon lamp or high-resistance voltmeter is more suitable.

Power and lighting fuses do not require special attention because there is no danger of blowing a good fuse with any of the more common testing methods. Any of these low-voltage fuses can be tested in place providing the test set is suitable for the circuit voltage and there is no danger of causing a short circuit with its attendant danger to the equipment and operator.

A blown fuse is an open circuit and any test which identifies the open fuse must tend to either complete the circuit to the load or complete a parallel

circuit to the opposite side of the line. Before checking the fuse know positively which is the line side and which is the load side. When one side of the circuit is grounded the test can be made between ground and fuse. As a precaution against overlooking a bad fuse keep one probe on potential and place the other on each end of the fuse in question. Testing diagonally across fuses or connecting the test set in parallel with the fuse will show up the open circuit.

Three-phase circuits complicate fuse testing because inductive load always produces voltage on the open side when only one phase of the circuit is broken. This means that testing fuses diagonally will not detect a bad fuse because of the potential both on the line and load side of the fuse. Connecting the test probes to both ends of each fuse in turn and watching for a slight spark at the probes rather than operation of the test set will indicate a blown fuse in a 3-phase circuit.

Another method, while not considered a safe practice, can be used in a pinch on low-voltage lighting circuits. Placing a good fuse against each load fuse so that the ferrules are in contact will identify a bad fuse by slight sparking when the ferrules touch. Don't use this method when the full load current is higher than 10 or 15 amps even on low-voltage circuits because high currents will cause a large arc instead of a small spark. There is also the danger of getting the good fuse across the line and causing a short circuit.

New York, N. Y. L C RINEHART

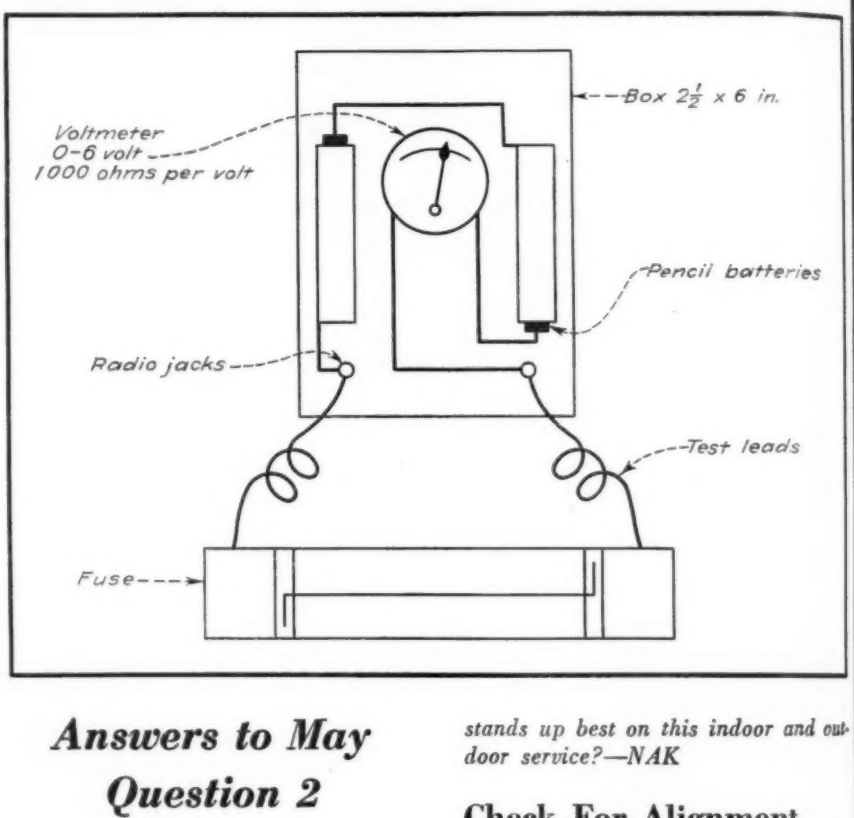
Use Sensitive Voltmeter

IT IS POSSIBLE for RJ to use one instrument for testing different fuses of various potentials, including the fuses for the 13.2-kv line. However, in my opinion, the safest and surest way to check all fuses is to de-energize the circuit in question and then place a high ohm-per-volt sensitive voltmeter, see sketch, or a foundation instrument (Volt-ohm-milliamp) operated in conjunction with pencil-light batteries, across the fuse; a deflection of the instrument needle shows a closed circuit, consequently the fuse is good.

I have found this instrument very useful in trouble-shooting with the General Motors, checking various intricate control circuits and today, after 12 years of service it is a faithful pal. As to the question of a cabinet, ground and live test being dependable—many plant maintenance men have been convinced that checking 3-phase 4-wire circuits against cabinet (ground) is not dependable especially if and when polyphase or 3-phase motors are installed.

Nevertheless, checking fuses diagonally would eliminate possible error. In conclusion I should like to add that any test depends upon the alertness and degree of accuracy of the individual performing such test. I could review unbelievable tests made by individuals on the line side of the fuse to ground, announcing the fuse OK, or checking high potential fuses with a low potential homemade testing device, consequently damaging such fuses. Therefore I prefer the use of high-ohm instrument which is safe, sure and simple for any test.

Schenectady, N. Y.
CARL BACHMANN



Answers to May Question 2

Disconnecting Switches

The Question

WE HAVE A LARGE NUMBER *of single- and double-bladed copper disconnecting switches inserted in equipment leads on each side of the respective oil circuit breakers. Some of the switches are in the powerhouse while others are exposed to the weather.*

These disconnectors have caused considerable trouble by cutting and dragging metal at both the hinge and clip.

Since this cutting causes a high resistance and consequent heating, the switches must be dismantled frequently and refaced. This practice causes inconvenience because of the amount of equipment which must be removed from service. Is there any safe method of testing these disconnectors for heating while normal load is being carried? Bus potential is 13,000 v.

What is the best method of resurfacing these switches? What lubricant stands up best on this indoor and outdoor service?—NAK

Check For Alignment

TO ELIMINATE CUTTING and dragging of metal on NAK's switches, check to make sure that switches are in line so that they will not drag on the blade and clip, when opening and closing switches. After checking alignment make sure the clips are tight so as to make good contact and thus prevent arcing—excessive arcing when operating the switches will roughen the blade surface, thus creating a condition that will increase resistance and heat the blade more than it would if it were smooth. If the blades are kept properly aligned and tightened at all times frequency of dismantling will be reduced considerably, which will take care of the indoor disconnecting switches.

Give outdoor equipment the same care but be on the lookout continuously, as foreign matter and weather have a direct bearing on disconnecting switch life. Lubricant will be required on the outdoor switches more so than on the indoor ones.

The only lubrication that I have seen

used is the so-called white vaseline or petroleum jelly, and it has always worked out fine. As for clearing up the roughness of any blade, I have always used a small flat mill file and finished the surface with sandpaper.

If the operator will use a piece of sandpaper at the first signs of roughness, extensive maintenance of these switches will be eliminated, and the time saved can be spent on other repair work.

If only certain switches show signs of heating then the wiring should be checked—it may be a case of improper type or size of switch for the current carried.

Philadelphia, Pa. T F CUNNINGHAM

Carbon Arcing Contacts

THE FACT THAT NAK's disconnects become hot is an indication of several conditions which may exist. First, the units may have insufficient capacity to carry the load. The remedy, of course, would be to install switches of greater cross-sectional area.

Second, the heating may be the result of poor contact on the clips. This should be investigated and tested by feeler gages when current is off.

The remedy is to remove the high spots and fit the faces as we might do in fitting a bearing or any other piece of equipment requiring close contact.

It may be necessary to close the clips in on the blades to give more positive contact. The smallest space between the blade and clip will cause an arc, which, no matter how minute, will burn up the surfaces with increasing intensity as time goes on and soon become a great contributing factor to increased temperature.

The question also seems to imply that these disconnects are pulled while some current is still flowing, which is at least unusual. If this is true I would advise the addition of carbon contacts attached to the blades, as shown at *A* in the accompanying sketch. These, making contact with a copper strip fitted to the top contacts will dissipate any arc when opening, are renewable and can be kept in good shape. Another method, *B*, using the split blade with quick opening spring, may be beneficial.

As a lubricant it is an accepted practice that pure vaseline is the best protection against seizing or binding of these switches.

Kearny, N. J. GEORGE MCNALLY

Lubricate Disconnectors

NAK's DISCONNECTOR TROUBLE comes from the tendency of similar metals to cut and drag when placed in sliding contact. Lack of lubrication, excessive pressures and abrasive dust all contribute their share in causing this.

If the disconnectors cannot be protected against abrasive matter frequent resurfacing of the switch parts will be required. Under extremely dusty conditions serious cutting can be prevented by dismantling and lubricating the hinge and clip at convenient intervals before metal dragging begins.

Cut areas can be resurfaced by draw filing or with emery cloth followed by polishing with crocus cloth. It is not necessary to remove deep cut marks unless they extend over a considerable part of the contact area.

Vaseline serves for lubricating indoor disconnectors but is not suitable for outdoor work. Parts exposed to the weather require grease of a more sticky nature which will resist washing action of rain. Heavy deposits of grease are not necessary and only serve to catch and hold dust. Cover the parts with a light film and then remove any excess by wiping with the palm of your hand.

When it is impossible to remove equipment from service except at long intervals it is advisable to check the disconnector frequently for heating. If this test is to be of any value it must be made under normal full-load conditions because cool operation under part load is no assurance that this same condition will prevail at full load.

For actual temperature measurements special pyrometric cones can be made up. Having several of these cones with different melting temperatures fitted into ordinary switch sticks provides one means of testing. A simpler method uses ordinary paraffin cut into stick form and inserted in a socket drilled into the end of the switch stick.

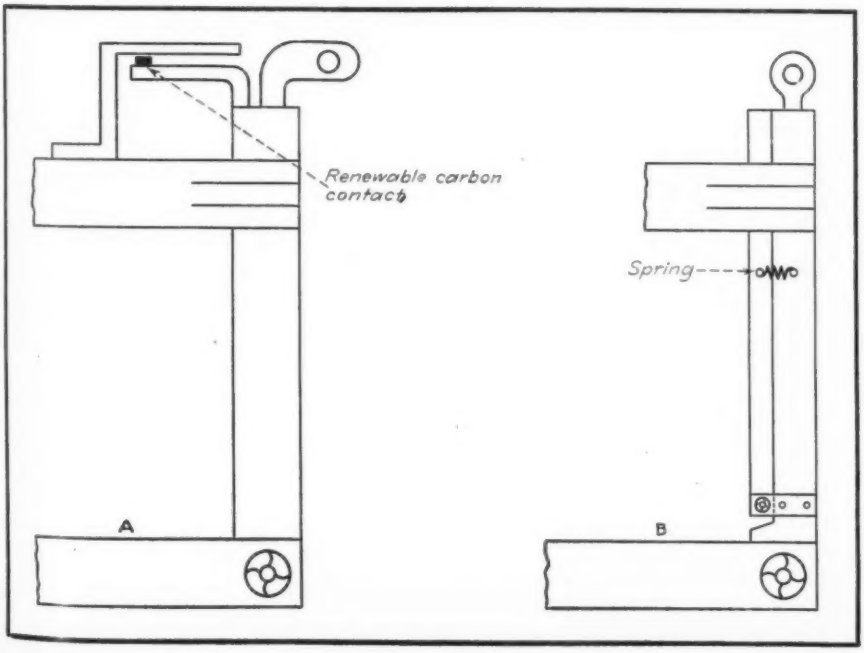
After a little experience with paraffin an operator can tell whether or not serious heating is taking place. When paraffin is rubbed over cool metal with light pressure a sticky action is noticed. With an increase in temperature this sticky feeling gets less and then gradually changes to a greater degree of oiliness. When enough heat is present to cause slippery movement this will be evidenced by a glazed area on the paraffin where it contacted the copper. If it appears that actual melting is taking place rub the paraffin over a sharp edge of the disconnector and scrape off a minute quantity of paraffin. Watch this closely for signs of melting.

Serious heating will show up in immediate melting of the paraffin and this is a good indication that the disconnector needs attention unless special temperature cones are available for making a more accurate temperature check.

Frequent cleaning, with adequate lubrication, will prevent cutting which can only be corrected by resurfacing. Repeated resurfacing will eventually remove sufficient metal to introduce a new problem of reducing contact pressure between the blade and hinge.

Contact between the blade and hinge jaws or clip must be equal over the entire area or heating will occur. Just tightening the hinge bolt or forcing the clip ends together is not the remedy for taking up clearance caused by wear.

Chicago, Ill. R O SMITH



Q&A QUESTIONS & ANSWERS FOR POWER ENGINEERS

By ALEX HIGGINS

4 Construction Materials and Details —Heat Treatments and Processes

Fourth in a series that is running in every number of POWER. *From long experience as a professional and practical engineer, Alex Higgins asks and answers some direct questions regarding construction materials and details; heat treatments and processes. In outstanding fashion he drills the young power engineer, polishes up the old-timer's knowledge, helps all comers pass engineer examinations and win certificates of higher grade. Besides being invaluable as a study course for examinations, it is a good review for the chief himself who wants to do a better job.—Editor.*

Construction Materials

Q 1—List the principal materials used in steam-boiler construction and name some of the parts for which each is especially suitable.

A—*Wrought steel* (also called low-carbon steel) For boiler plates, bolts, tubes, rivets, stays, pipes, reinforcing rings, manhole door frames, mud drums, nozzles, manhole and handhole covers.

Cast steel For high-pressure fittings, valves, tube headers, manhole and handhole cover plates, supporting lugs.

Wrought iron For tubes, pipes, staybolts, rivets, door-frame rings.

Cast iron For valves, pipes, fittings, water columns when pressures do not exceed 250 psi and temperatures are not over 450 F. Cast-iron fittings on blowdown lines are limited to 100 psi.

Malleable cast iron For pipe fittings, water columns, valve bodies.

Brass For small valves, gage glass fittings, parts of gages, pipe.

Bronze For safety-valve seats and same purposes as brass.

Copper For plates and tubes.

Alloy steels Steels containing small percentages of other metals, such as nickel, chromium, molybdenum. Commonly used when greater strength is required and metal is subjected to high temperatures.

Q 2—Explain briefly how wrought steel, cast steel, wrought iron, cast iron, malleable cast iron, chilled cast iron, brass, bronze, copper and alloy steels are manufactured.

A—*Wrought steel* Composed primarily of the element iron, combined with small percentages of other elements, notably carbon (generally less than 0.3%). First step in the manufacture of iron and steel is the smelting of iron ore in a blast furnace, with limestone as a flux and coke as fuel. The molten metal is cast in narrow molds as "pigs." The process of manufacturing wrought steel consists of melting this pig iron again in a suitable furnace, usually an "open hearth," burning off the carbon and other impurities, then adding whatever amount of carbon may be required for the desired grade of steel. The finished steel usually contains small percentages of manganese, sulphur and phosphorus as well as carbon. Molten metal from the steel furnace is run off into ingot molds, and these ingots are rolled, forged or pressed into plates, bars, angles and other shapes.

Cast steel Cast directly from the steel furnace into molds of any desired shape and not formed by rolling or any other process.

Wrought and Cast Iron

Wrought iron Made by melting pig iron in a "puddling" furnace and working it in such a way as to remove practically all carbon. The pasty mass that is left is almost a pure iron.

Cast iron Made by melting pig and scrap iron in a cupola furnace; then running the molten metal into molds. Iron castings made in this way may contain a large amount of free carbon; that is, carbon that is not combined with the iron, but is in the form of graphite. Cast iron high in free carbon is called gray cast iron because of its gray appearance when machined. It machines easily and is rather weak in structure. Cast iron that is low in free carbon is somewhat more like steel. It has a white appearance when machined and is harder and stronger than gray cast iron.

Malleable cast iron Produced by annealing "white-iron" castings. Packed with oxide of iron in cast-iron boxes, the castings are heated to red heat. They are kept at this temperature for a considerable time, then allowed to cool slowly. This makes the castings more or less malleable, that is, capable of being bent or worked to some extent.

Chilled castings Made in special molds that cool or chill outer surface of the casting rapidly, thus making it very hard.

Copper Copper ore is first crushed fine, then washed, screened and concentrated, rewashed and smelted to a "copper matte." The matte goes through a further refining process to burn out such impurities as sulphur and iron. The resulting blister copper, about 99% pure, is further refined before being manufactured into wire, rods and bars.

Brass Principal ingredients are copper and zinc. Some brasses contain small amounts of tin and lead as well. They can be made soft or hard by varying the proportions and the amount of cold working.

Bronze Contains copper with either zinc or tin, or both. Many modern bronzes contain such elements as aluminum, nickel, etc.

Alloy steels Made by the same processes as wrought and cast steel, but containing small percentages of other metals, such as chromium, nickel and manganese. In boiler work, alloy steels are used for plates and castings for high temperatures (750 to 1100 F).

Q 3—The following eight terms refer to the physical properties of materials. Explain their meaning briefly:

A—1. *Ductility* Ability to withstand drawing out or other deformation without breaking.

2. *Elasticity* Ability to return to normal shape after a deforming force has been removed.

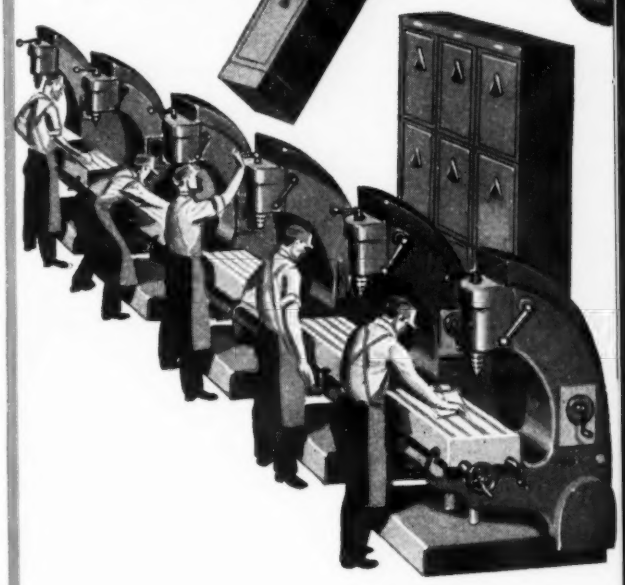
(*Continued on page* 116)

Multiple control can be housed in a UNITROL Section alongside the machine it serves.

To All Users of Motor Control

HOW TO BUY FOR TODAY and be READY FOR TOMORROW

Control for a machine group or department can be centralized in nearby unused space.



The motor control you buy today *can* be a wise investment that will better prepare your plant for peacetime reconversion . . . simply *insist on UNITROL,* the *unitized* and interchangeable control equipment that can be "converted" at will!

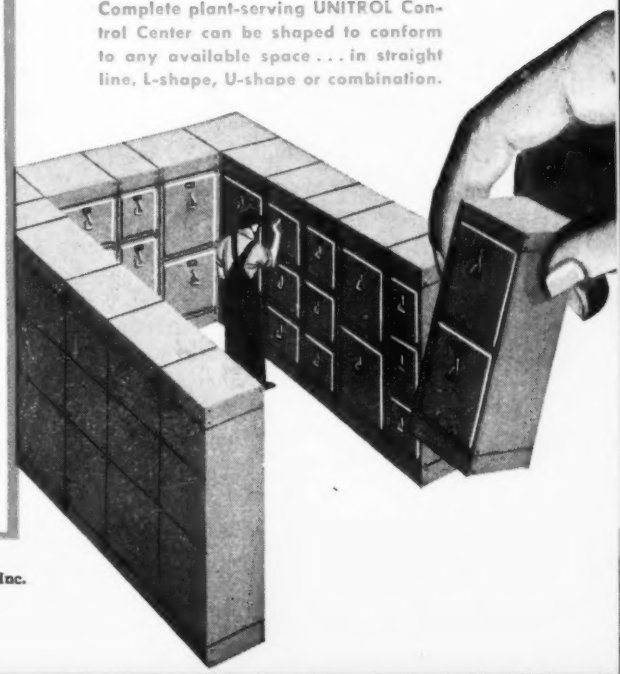
Here's why UNITROL is a sensible buy today. It lets you get 2 to 3 times as much control into the same space, lets you arrange your plant's motor control to conform to individual needs, lets you take advantage of "odds and ends" of space and meet your particular manpower requirements. It installs fast, needing only to be electrically connected.

Here's why UNITROL is a good investment for tomorrow. UNITROL is like your sectionalized filing cabinets. Each control unit can be removed easily and quickly, placed in some other compartment, or replaced. Entire sections can be shifted or removed. The complete plant-serving UNITROL control center can be reshaped, reorganized or expanded as your post-war operations demand.

Before you buy *any* motor control now, send for the 36-page UNITROL book. It's free. Write today. CUTLER-HAMMER, Inc., 1358 St. Paul Avenue, Milwaukee, Wisconsin.

Associate: Canadian Cutler-Hammer, Ltd., Toronto, Ontario.

Complete plant-serving UNITROL Control Center can be shaped to conform to any available space . . . in straight line, L-shape, U-shape or combination.



CUTLER-HAMMER
UNITROL
C-H

Copyright, 1943, Cutler-Hammer, Inc.

Q&A FOR POWER ENGINEERS

(*Continued from page* 114)

3. *Malleability* Capable of having the shape changed by rolling, hammering or bending, without cracking or breaking.

4. *Hardness* Ability to withstand surface wear or abrasion.

5. *Toughness* Measure of a material's ability to stand up without fracture under repeated twisting or bending.

6. *Homogeneity* Refers to the internal structure of a material. When broken, homogeneous material shows uniform grain or fiber.

7. *Tenacity* (high tensile strength) Ability to stand large pulling force.

8. *Resilience* Ability to store up energy under stress and give it back when stress is removed.

Physical Properties

Q 4—What are the physical properties of low-carbon steel, wrought iron, cast iron, cast steel and brass?

A—Only a very general answer can be given, as all these metals vary widely in quality because of different manufacturing methods, varying proportions of alloying metals and impurities that cannot be entirely eliminated. Broadly speaking:

Low-carbon steel is ductile, malleable, tenacious, tough, elastic and fairly homogeneous.

Wrought iron possesses much the same physical properties as low-carbon steel, but has lower strength. It is tougher and more ductile and its internal structure is fibrous.

Cast iron is hard, brittle and less uniform in structure than wrought iron and steel—also much weaker in tension.

Cast steel is far stronger than cast iron especially in tension and resistance to impact.

Brass varies from a hard and brittle material to a ductile, tenacious one, depending on the proportions of the various metals in the alloy.

Q 5—What is the main difference between iron and steel?

A—Chemically pure iron is an element, or simple substance, that cannot be divided up into anything but particles of the same substance. In practice, it is almost impossible to refine iron so that it is free from all foreign material, but a high-grade charcoal iron really contains few impurities. Steel is an alloy of iron and carbon. The carbon is in solution with the iron, increasing its strength and changing its physical properties to a marked extent.

Steel contains only a very small percentage of carbon, which is combined chemically with the iron. Cast iron, on the other hand, may contain quite a substantial amount of carbon, mostly in a "free" state, that is, simply *mixed* with the iron in the form of graphite.

Q 6—What is the difference between low-carbon steel and high-carbon steel?

A—Low-carbon steel contains a very small percentage of carbon, from 0.1 to 0.27% in soft malleable steel, such as is used for plates, bolts and rivets, to as much as 0.6% in harder steels used in manufacturing rails, hard steel wire, etc.

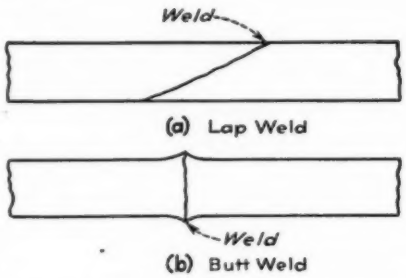


Fig. 1—Hammer-welded joints may be lap, as in (a), or butt, as in (b)

High-carbon steel contains from 0.6 to about 1.5%. A 1% steel is suitable for such heavy-duty tools as chisels, punches, rock drills. Turning tools, drills for metal, reamers and dies are made from steel containing from 1 to 1.3% carbon.

Low-carbon steel is easily welded but cannot be hardened. High-carbon steel can be hardened but may not be so readily weldable.

Q 7—What is an alloy steel?

A—An alloy steel contains some other metal or metals, in addition to carbon and iron. Common alloying metals are chromium, nickel, manganese, silicon, vanadium, molybdenum and tungsten. *Chromium* increases hardness and tenacity without reducing toughness. It is used extensively in high-speed tools and rustless steels; *nickel* greatly increases the tensile strength, ductility, elasticity and corrosion resistance; *manganese* increases hardness and toughness; *silicon* increases hardness and magnetic permeability, making steel particularly suitable for electromagnets; *vanadium* increases resistance to fatigue; *molybdenum* increases hardness and offers greater resistance to heat changes, and *tungsten* hardens and increases heat resistance. It is the main alloying constituent in self-hardening tool steels.

Heat Treatments and Processes

Q 8—How is carbon tool steel hardened and tempered?

A—Carbon tool steel is hardened by heating it to about 1450 F, then cooling it rapidly by plunging it into water or oil. The steel is not quite so hard and brittle cooled in oil as in water, but in either case it is usually too hard and must be "tempered," that is, some of the hardness drawn out. If the hardened steel's surface is polished and the steel reheated, colors appear, ranging from light straw to deep blue, as temperature increases. The darker the color, the higher the temperature and the softer the temper. If the tool is heated until the blue color appears, practically all hardness has been drawn from the steel. The tempering process can be stopped at any desired point by quenching the steel in oil or water.

Q 9—List some common carbon-steel tools and their tempering colors.

A—In the following tools, carbon steel ranges from hardest to softest, in order given: *Light straw* Scrapers, files, lathe and planer tools for hard materials. *Straw* Milling cutters, lathe tools, taps, dies, reamers, drills. *Brown* Cold chisels for hard materials, woodworking tools. *Brownish purple* Cold chisels for soft materials, woodworking tools. *Dark blue* Springs, wood saws.

Q 10—What is meant by annealing?

A—Annealing is the process of softening metal and relieving internal strains by heating to a temperature between the recrystallization temperature and the lower critical temperature. Rapid heating and short holding time prevent excessive grain growth. It is customary to cool the parts in air. If surface protection is desired, controlled cooling temperatures are used.

Q 11—What is case hardening?

A—A method of hardening the surface of those irons and steels that cannot be hardened by simply heating and then cooling rapidly. One method is to heat the metal to a cherry red, coat the surface with potassium cyanide or potassium ferro-cyanide and then chill suddenly by dipping in water. The cyanide carbonizes surface of metal, really converting it into steel that can be hardened by heating and sudden cooling.

Q 12—What is soldering?

A—Process of joining two pieces of metal by covering their surfaces with a molten alloy of lead and tin, called solder. Parts to be joined are first

(*Continued on page* 118)

YARWAY IMPULSE TRAPS
Serve Landers Corporation

THE Landers Corporation, of Toledo, Ohio, manufacturers of artificial leather, say: "We first started using Yarway Impulse Traps six years ago because we needed a trap that would be *efficient at all steam pressures* in the mill *without adjustment or change of parts.* Soon after we started using them we found that Yarway Traps could *heat up our coils twice as quickly* because they could *handle air in large quantities.* Today, we have over 200 Yarway Impulse Traps on all kinds of services."

Real satisfaction in service needs little further comment except that this is a typical experience of users who have purchased more than 200,000 Yarways to date. *So easy to install; small size; quicker heating and greater sustained heating efficiency; low cost, often less than repairing old traps,* are other reasons why you should standardize on Yarway Impulse Traps.

See your Mill Supply Dealer or write for Bulletin T-1737.

YARNALL-WARING CO., 100 Mermaid Avenue, Philadelphia

on

UNIT HEATERS
RADIATORS
CLOTH DRYERS
COOKERS
STEAM HEADERS
KILNS

YARWAY IMPULSE STEAM TRAP

(Continued from page 116)

cleaned to the bright metal, then coated with flux and "tinned" by spreading molten solder thinly over the surface with a soldering copper, blow torch or other source of heat. More flux is applied and surfaces to be joined are clamped together and heated, while additional solder is flowed into the joint. Parts are allowed to cool before pressure is released.

The flux helps the solder to flow and to form a firm bond with the metal being soldered. Common fluxes include rosin for tinned steel, rosin and tallow for lead, borax for iron, sal-ammoniac for copper and brass. Chloride of zinc is a good general-purpose flux. In addition, several good prepared paste and liquid fluxes are on the market.

Q 13—What is brazing?

A—Brazing is somewhat similar to soldering, except that the strength and melting point of the joining material is much higher. While commonly called "spelter" by practical brazers, the material for high-temperature brazing is actually granulated brass with a melting point ranging from 1450 to 1800 F, according to its composition. So-called "low-temperature" brazing is done with silver alloys ranging in melting point from 1175 to 1600 F. Usual heat source is an oxyacetylene torch. Borax or other flux must be used. A brazed joint is very much stronger than a soldered joint.

Q 14—What is forge welding?

A—The joining of two pieces of metal by heating to their plastic point, then placing in contact and hammering or pressing them together before they cool. When welding heat is reached, metal is sprinkled with a flux to remove oxide from the molten surfaces and thus insure a clean joint. Sand and borax or sal-ammoniac is commonly used for this purpose. Strength of weld depends on the cleanness of surfaces to be joined and the extent to which they really fuse. If temperature is not up to correct welding heat, metals will not fuse. Heated above welding heat, they will burn. A good weld is practically as strong as the solid metal.

Q 15—Using sketches, explain what is meant by a lap weld and a butt weld (both forge welds).

A—In *lap welding*, ends to be welded are first heated and "scarfed," as in Fig. 1(a). They are then heated to welding temperature and welded by hammering, with ends overlapped as shown. In *butt welding*, ends are heated to welding temperature, joined by simply butting them together, as in Fig. 1 (b), and finished by hammering.

Q 16—What is fusion welding?

A—Any process that joins metals while in a molten state without hammering or other pressure. Oxyacetylene and arc welding are examples of fusion welding.

Q 17—What is thermit welding?

A—Chemical action obtained by igniting a mixture of aluminum powder and iron oxide, called thermit, produces molten steel at a temperature around 5000 F. This molten steel is run into a mold surrounding the parts to be welded, melting the parts and solidifying with them as steel cools. It is essentially a casting process.

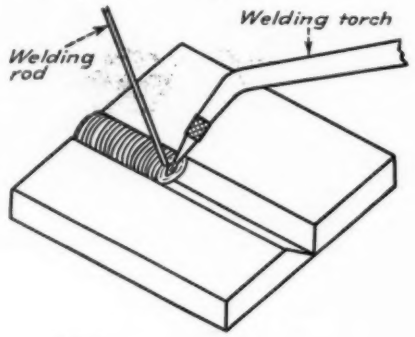


FIG. 2

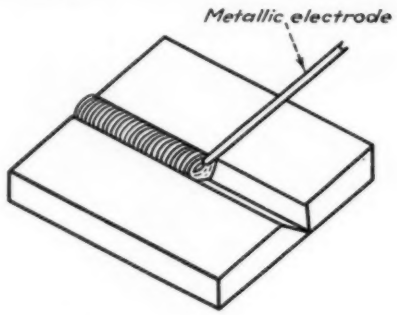


FIG. 3

Fig. 2—Oxyacetylene welding. In general, the torch is given a circular or weaving motion in gas welding. Fig. 3—Metallic arc welding. In arc welding, arc is commonly formed between welding rod and the work. (A second method uses a separate carbon arc.)

Q 18—Explain oxyacetylene welding.

A—In the oxyacetylene process of fusion welding, the joint between parts to be welded is thoroughly cleaned and in many cases cut out in V-shape. This vee is filled in by melting a rod of similar metal into the joint and, at the same time, fusing the edges of the metal to be joined with the metal of the filler rod. If fusing is properly done, the joint is practically as strong as the original metal. Heat required to melt the metal is applied by means of a blowpipe, burning a mixture of oxygen and acetylene gas that produces an intensely hot flame. Flame must be kept moving with a circular or weaving motion to spread the heat and avoid burning the metal. Fig. 2 shows how an oxyacetylene weld is made.

Q 19—What are the principal methods of electric welding?

A—The three common processes are:

Resistance welding Parts to be welded are raised to fusing temperature by the passage of a heavy electric current while they are in contact with each other. Spot welding of light metal parts is one form of resistance welding.

Carbon arc welding Parts to be welded are connected to one leg of an electric circuit; the other leg is connected to a carbon rod held in a hand receptacle. When the carbon rod touches the metal surfaces to be welded, and is then moved back a fraction of an inch, an arc is formed. Heat of the arc melts the metal, and a filler rod of similar metal held in the arc fills up the joint.

Metallic arc welding A wire electrode is used instead of the carbon rod, and the arc is formed between the rod and the metal to be welded. The electrode itself melts and fills the joint. Electrodes are bare wires or, more commonly, metal rods coated with some flux. Fig. 3 shows this method of electric welding on a prepared V-joint. The electrode is constantly moved in a "weaving" pattern during the welding process. Pattern varies with types of joint.

The Receeprocatin' Mon

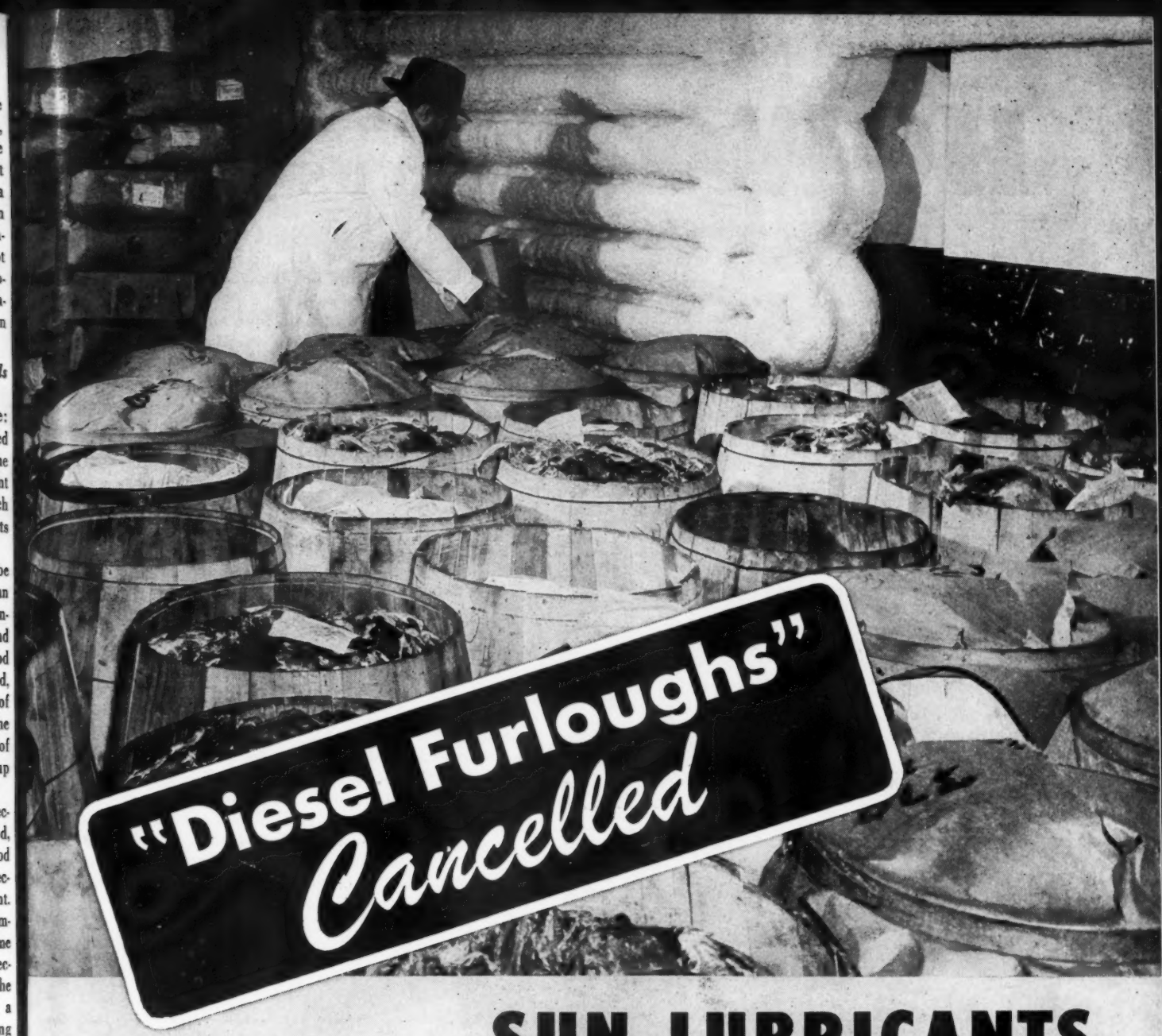
Oh! woesome 'oor that saw the birth
O' turbine thochts in Parsons heid,
I weesh that I wis aff the earth
Or else the turbine men wer' deid.

I'm a receeprocatin' mon,
I luve tae hear the bearin' bump.
Or yet, the piston groan an' grunt
That's religated tae a pump.

This whurligeein' thing I hate,
For whatna guid is it tae dae?
Tae see the fearsome thing gyrate
Gar's me puir stummick gang agley.

I widna care if it had ocht
Tae need a tender fitter's hand,
But it rins sae weel sin' it was bocht
I havna had to slack a gland.

I hate the tribe of whurligeegs,
It's just a pinch o'steam, then scat:
I'm a receeprocatin' mon
I stan' or fa' wi' Jamie Watt.



SUN LUBRICANTS

educe Diesel Shutdowns 75% In Cold Storage Plant

the face of the critical shortage of foods, unfailing d storage is vital. Every step should be taken to avoid wntime in refrigeration . . . and putting the right troleum product in the right place is one of the most portant steps.

arge cold storage plant proved this when they switched SOLNUS OILS. Previously their diesels had to be shut wn for inspection and cleaning at frequent intervals due excessive carbon formations. Oil filters were so clogged h carbon and sludge that they had to be replaced.

er the switch to SOLNUS, shutdowns for inspections were reduced 75%. Hard carbon troubles vanished. SOLNUS OILS keep the plant running day and night without breakdowns due to faulty lubrication. These wholly distilled, durable lubricants are low in carbon content—neutral in acidity.

What have you done to put your plant on a more efficient war-time operating basis? Talk it over with a SUN "Doctor of Industry" and let him prove to you the value of applying the right petroleum product at the right place. Write

SUN OIL COMPANY, *Philadelphia*

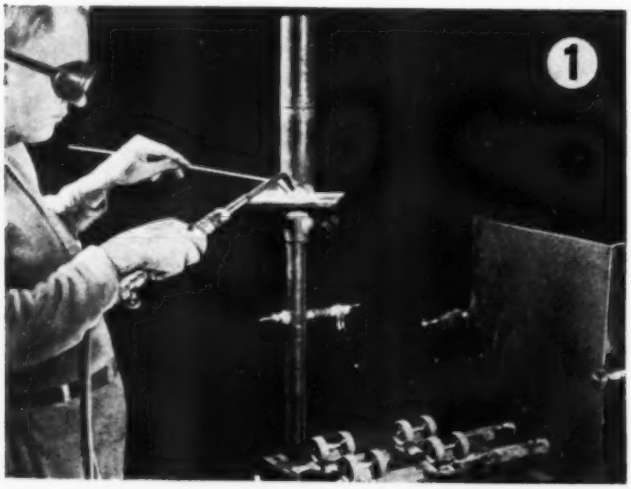
Sun Oil Company, Limited . . . Toronto, Canada

SUNOCO

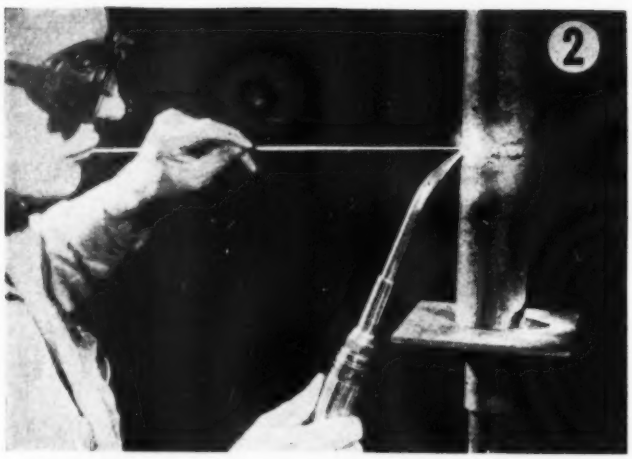
UN PETROLEUM PRODUCTS *HELPING INDUSTRY HELP AMERICA*

HOW TO MAKE HORIZONTAL WELDS IN PIPE

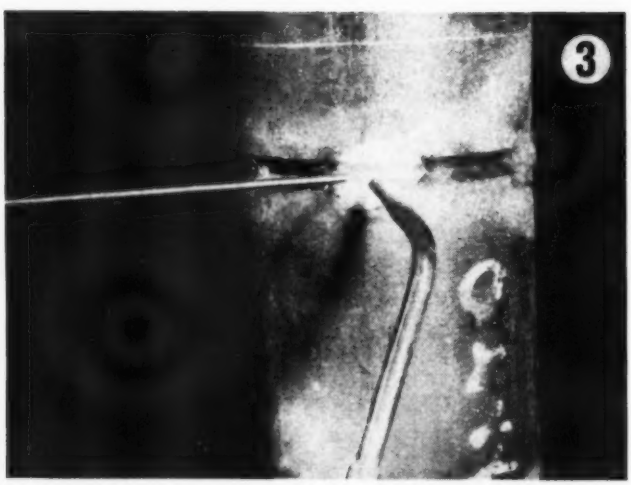
This is the fourth of a series teaching the basic elements of pipe welding, for beginners and for experienced welders who want to break in new men. Refer back to April POWER *(page 126) for list of materials and preliminary instructions. Pictures and data by courtesy of Linde Air Products Co.*



1 In work around the plant, horizontal welds often have to be made in pipe; these exercises give practice in producing such welds in 2-in. and 6-in. pipe. Start by taking two lengths of 2-in. pipe and tack welding them in three places, as described in May POWER, page 122. This time stand the pipes on end to make the line of the weld horizontal. To prevent overturning the pipes during the welding operation, tack weld them to the plate on the roller rig. Use bronze rod for this latter tack weld; it will be easier to melt loose later, and will not mar the plate. Photo shows pipe being tack welded to plate



2 Adjust the setup so that line of weld stands about at operator's eye level. Start weld halfway between tack welds. Hold blowpipe so that tip is horizontal and at about 45 deg to pipe surface. Heat an inch or a little less of the two edges, playing heat between them so they melt and run together. Go back and fill in with rod, which should also be horizontal and almost, but not quite, parallel to line of weld. Rod and blowpipe should form an angle of about 90 deg. Lower blowpipe when adding rod so that flame points slightly upward as shown in photo. Force of flame will keep molten puddle in place. Be sure both rod and base metal melt but keep puddle as small as possible. If it seems that puddle may get out of control and run down side of pipe, flick flame away momentarily and metal will tend to solidify. When weld is finished, mark starting point with soapstone



3 To practice horizontal welds in larger pipe, bevel, line up, space and tack weld two 6-in. lengths of 6-in. pipe, following procedure outlined in May POWER, page 124. Tack weld them with bronze to the plate on the blowpipe bracket of the roller jig, in the same manner as the 2-in. specimens, so that the pipe stands vertically with line of weld horizontal at eye level of operator. Again start weld halfway between tack welds, holding blowpipe and rod in positions shown in photo.

A beginner usually requires three passes for a horizontal weld in metal of this thickness; with a little experience it can be made in a single pass.

First, melt and close bottom of vee for about an inch or an inch and a half, using a little metal from the welding rod. This should be done by welding from right to left (forehand). Then, welding left to right (backhand) to the starting point, add only sufficient rod metal to half fill the vee. In the third pass, again welding in the normal right-to-left direction, completely fill the vee and build up the weld slightly as reinforcement. Then start closing the spacing gap in the next section and continue thus, section by section, all the way around the joint.

Be careful to avoid overmelting outer edges of vee. If lower edge is preserved, it aids greatly in controlling the molten puddle. If the upper edge melts down it will only have to be built up again, increasing rod consumption and gas and also boosting length of time required to complete weld. However, do not fail to get thorough fusion.

. . . is o.k. for savages

THEY thrive on it. But civilized man depends upon science. He goes to trained specialists, fact finders, for every phase of his activities.

Nalco's water treatment laboratories, the world's finest, have revolutionized certain phases of water treatment to the benefit of Nalco customers who have fewer boiler outages, more boiler capacity, lower operating costs. Join the more than 4000 satisfied Nalco customers who have ended their water treatment problems *permanently*. Write today.

Photo in Nalco Laboratories

NATIONAL ALUMINATE CORPORATION
6222 W. 66th Place Chicago, Ill.

Canadian inquiries should be addressed to Aluminate Chemicals, Ltd., 555 Eastern Ave., Toronto, Ont.

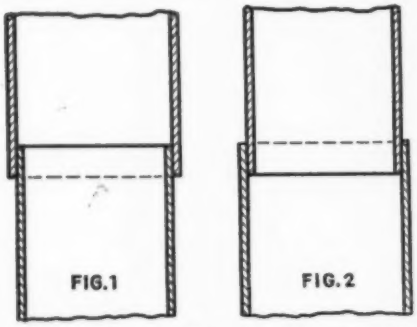
. . . the complete water treating service

Nalco

ARGUMENT CORNER

Use Weathered Joints Made Correctly

I WAS INTERESTED in the short article "Wrong Laps and Corrosion Ruin Steel Stack," in the November number (POWER, November 1942, pg. 117). If the joints, Fig. 1, had been properly made no trouble should have been experienced from corrosion with them. I think I am safe in saying that most steel chimneys are erected with laps



weathered as in Fig. 1, and not made as in Fig. 2. Whether the joints, Fig. 1, are bolted or riveted, if properly made, they should not cause stack corrosion.

Shipley, England T H CARR

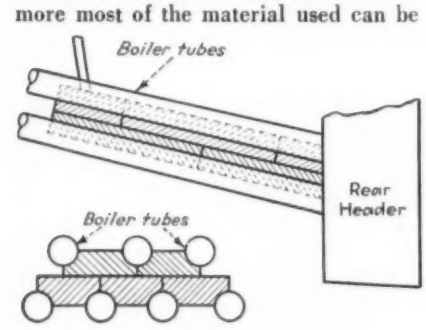
Increase Furnace Volume for More Capacity

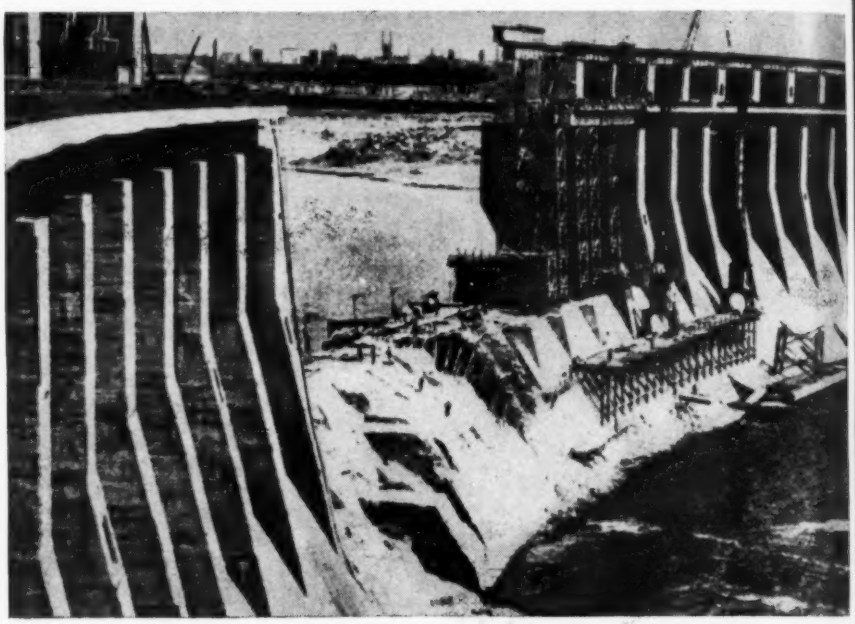
APPARENTLY through knowledge of or by accident Oliver Rantanen has used a furnace design, (POWER, April, 1943, pg 107), known years ago as a Webster furnace. The final furnace, Fig. 4 in the article, was developed from the design, Fig. 1. The design, Fig. 2, has been used extensively for burning coal and I believe could be used to advantage at the present time as the cost of change from Mr Rantanen's Fig. 1 to his design Fig. 2 would not be very great. Furthermore most of the material used can be found around the average boiler room.

Material needed would be one set of grates the width of the furnace and some T and C tile. In an emergency firebrick and a plastic refractory could be substituted. To enlarge the furnace, if the extra grates are 30 in. long, move the bridgewall back that distance. I believe this idea could also be used with some types of underfeed stokers to give greater furnace volume, by installing grates back of the stoker.

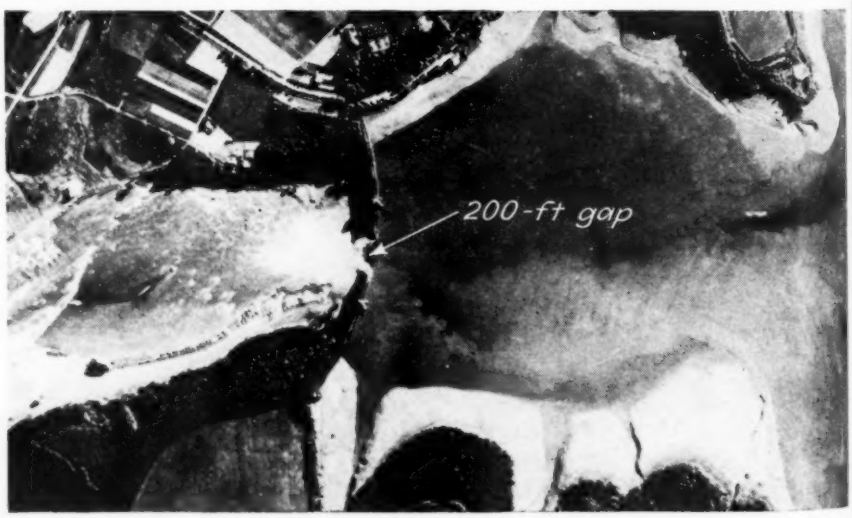
A double row of T tile makes a better roof than does the roof tile used by Mr Rantanen. As shown in the diagram the upper layer of tile seals the joints of the bottom layer. When gas or oil is

(*Continued on page* 146)





Work is progressing on the extension of the gigantic Dnieprostroy Dam on Dnieper River at Zaporozhe, Russia, which was blown up by the Russians when they were retreating in August, 1941. (For photo showing dam at the time it was blown up, see POWER, October 1941, p 96.) *(Acme Photo.*



One of the RAF's biggest targets, the Moehne Dam, shown above, has a reported installed capacity of 8800 hp. This is one of the dams recently blown out, causing hundreds of tons of water to descend into the Ruhr river valley. This dam is reported to have impounded about 36,000,000,000 gallons of water *Press Association Wire Photo*

facts

concerning replacement parts for

DE LA VERGNE DIESEL ENGINES

America's war production has created unprecedented demands for De La Vergne diesel engines. Our shops are working 24 hours a day, producing De La Vergne diesels to aid our armed forces to bring Victory at the earliest possible moment. Naturally, new diesel engines must come first. But in spite of this, we are doing everything in our power to produce replacement parts despite the difficulty in securing critical and other materials.

You can aid the war effort, yourself, other owners and us here at Baldwin by ordering only those replacement parts you need to keep your De La Vergne in operation. We will do our best to get you what you need, as quickly as we are permitted to make and ship parts.

Your cooperation and patience will be sincerely appreciated, by us, our many customers and those units of the armed forces which are using De La Vergne to speed Victory. Baldwin De La Vergne Sales Corp., a subsidiary of The Baldwin Locomotive Works, Philadelphia, Pa.

BALDWIN

De La Vergne

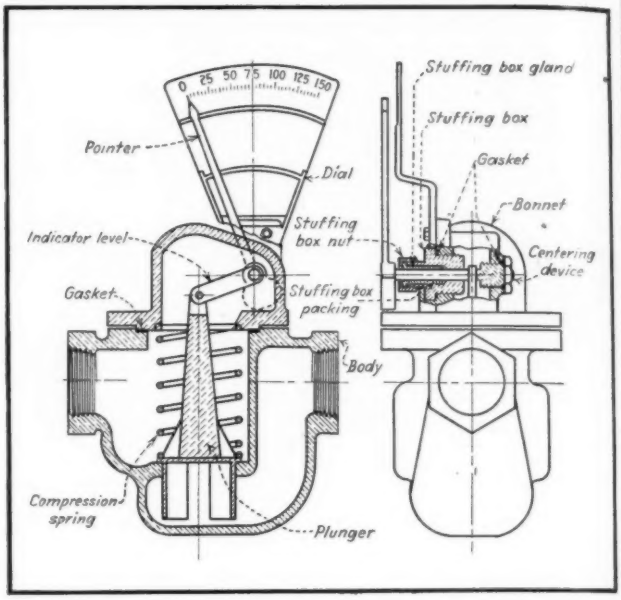
SALES CORP.

SUBSIDIARY OF THE BALDWIN LOCOMOTIVE WORKS • PHILADELPHIA

WHAT'S NEW IN PLANT EQUIPMENT

BLOWDOWN, LIQUID FLOW INDICATOR

HENSZEY FLOW indicator was developed to indicate accurately the rate of flow of hot dirty blowdown from steam boilers. The indicator is adaptable to indicating the rate of flow of liquids such as boiler feed water, condensate, gasoline, light oils, milk, chemicals, etc. In operation, water enters the indicator below the plunger and forces the plunger upward off its seat. This exposes slots on the side of the plunger through which the water passes. An increase in flow would increase the lift of the plunger and expose a greater area of slots. The slots are so proportioned that the lift of the plunger is in proportion to the rate of flow of the water. When no water is flowing the plunger rests on its seat and the openings to the meter are entirely closed. Any flow of water must lift the plunger in order to pass through, therefore the pointer indicates on the scale even the smallest flows. *Henszey Co, Watertown, Wis.*



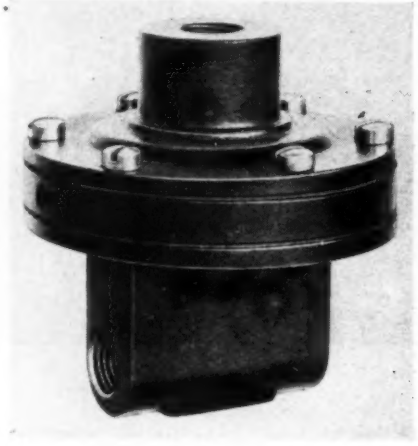
Inspection Mirror

SOMETIMES IT IS NECESSARY to inspect work from behind or obstructions sometimes block the view and the only means of seeing the work is with an adjustment inspection mirror. This "See-Eee-Zee" Mirrorview has been designed for this type of job. A useful feature is convenient locking device operated by one hand, by means of

which the mirror can be locked at any position within a 90-deg arc after it has been inserted past obstructions. These tools are of tubing, rod, and sheet metal, zinc plated and work freely and easily. Mirrors are good quality glass and are said to be free from distortion. *Snap-on Tools Corp, Kenosha, Wis.*

Booster Relay Air Valve

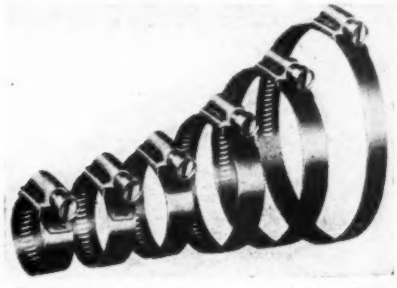
COMPANY ANNOUNCES ADDITION to line of air valves an auxiliary device, providing accelerated valve action to eliminate the effect of lag in large diaphragm motors and/or in long air lines between



controlling instruments and diaphragm motors. Under these difficult conditions relay air valve will inflate or deflate largest Taylor valve motor (diaphragm of 144 sq in.) from five to seven times faster than by controller alone. Installed in air line adjacent to diaphragm motor it actuates the diaphragm valve by means of an independent air supply of 25 to 150 psi, applied or relieved through large ports. This action is in direct proportion to controller output. Process stability is increased by causing valve action to follow closely controlling instrument output changes. Required set points can be maintained on those applications where time lags and capacities are small. *Taylor Instrument Companies, Rochester, N. Y.*

Hose Clamps

AERO-SEAL HOSE CLAMPS come in sizes from ¾ to 4 in. inside hose diameter. Clamp consists of a ⅝-in. tempered-steel band punched with holes corresponding to the teeth of a worm gear. These holes mesh with a worm in the housing welded to the fixed end of the band. The worm is turned by a screw driver and the screw head on the work is fitted with a safety cup



which prevents the screw driver from slipping and puncturing the hose or damaging other equipment. *Aircraft Standard Parts Co, 1711 Nineteenth Ave, Rockford, Ill.*

Relay Case

COMBINING A RELAY AND KNIFE BLADE TEST SWITCHES in same unit with maximum flexibility in maintenance and testing, type FT Flexitest cases are for panel mounting. Present standard relay elements are used in the new

(*Continued on page* 126)

A 100% RECORD

Awards on May 8th, 1943 to two plants in Kenosha, Wisc., completed this 100% record for The American Brass Company.

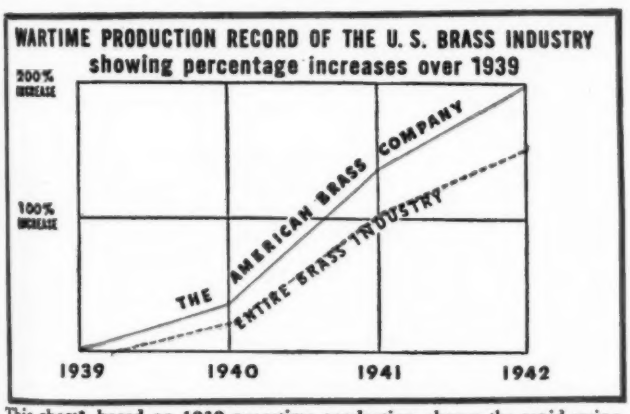
ALL TEN AMERICAN BRASS CO. PLANTS IN U. S. A. HAVE EARNED RIGHT TO FLY ARMY-NAVY "E" FLAGS

This is the story in terms of war production

Our Connecticut plants were among the first in the brass industry to receive the coveted "E" Award for outstanding production of war materials. Since then *all* our plants, including those in the States of Michigan, Wisconsin and New York, have been similarly honored.

As the largest fabricator in the copper and brass field, The American Brass Company is keenly aware of its responsibility and its opportunity to serve the cause of the United Nations.

Since 1939, production has been tripled, with virtually every pound today going for war purposes.



This chart*, based on 1939 peacetime production, shows the rapid swing into all-out war production, both by the copper and brass fabricating industry and The American Brass Company (not including Government-owned plants). All-time production records have been continually broken ever since the National Defense Program was initiated in 1940.

*Based on compilations of The American Bureau of Metal Statistics

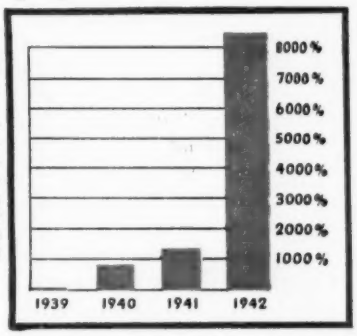
This record was accomplished by close cooperation between management and labor . . . careful planning for rapid conversion to wartime operations . . . intensive training of new personnel . . . plus efficient utilization of existing and new plant equipment.

Detailed figures, of course, cannot be revealed, but The American Brass Company is consistently breaking all previous volume records. In addition to its U. S. plants and that of a Canadian subsidiary, Anaconda American Brass Ltd., the company's production also embraces three plants operated for the United States and Canadian Governments.

Shipments this past January were the largest in the company's history. March exceeded January. The first quarter of '43 was by far the greatest tonnage quarter in the records of the company.

PRODUCTION OF COPPER ALLOYS FOR AMMUNITION by The American Brass Co.

This chart shows the vast increase in production of copper-base alloys directly earmarked for ammunition in plants operated by The American Brass Company. This is one of the most vital needs for copper and brass. Tremendous quantities are required for all types of ammunition.



The American Brass Company is proud indeed that all the plants it operates in the U. S. A. have won the honor of flying the Army-Navy "E" for excellence in production. But it is even prouder of the organization and the will-to-produce that have made this record possible . . . *and will keep it going.*

43184G

THE AMERICAN BRASS COMPANY

ANACONDA

Subsidiary of *Anaconda Copper Mining Company*

BUY ALL THE BONDS YOU CAN AFFORD . . . TURN IN ALL THE SCRAP YOU CAN FIND

WHAT'S NEW IN PLANT EQUIPMENT

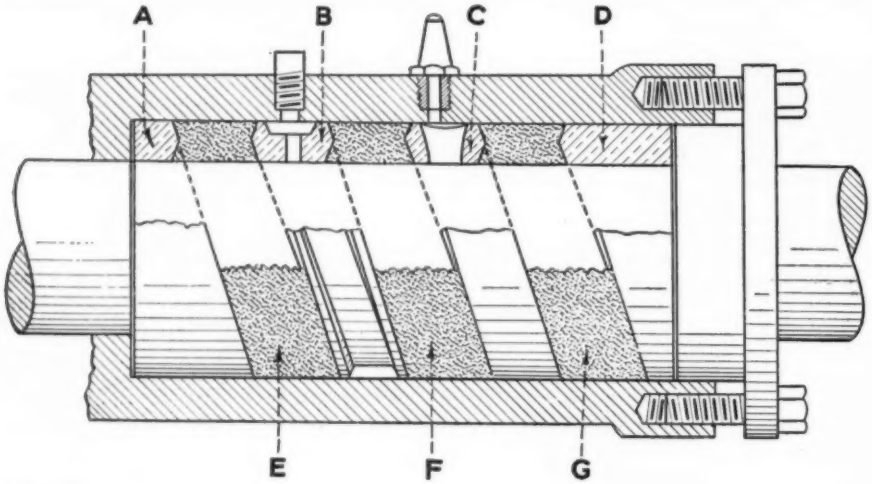
(*Continued from page* 124)

cases and are mounted on a removable unit chassis. Test connections can be made either by clip leads or test plug. The test switches are of high capacity, self-aligning knife blade construction with the movable blade and hinge jaw mounted on a molded block rigidly fastened to the case. Each circuit can be identified by cards on the switch handle and a red handle identifies the trip circuit. *Westinghouse Electric & Mfg Co, East Pittsburgh, Pa.*

V-Belt

ALL-LEATHER V-belts have side walls of full grain leather firmly cemented on a leather core. Company describes the features of the V-belt briefly as a new innovation to save production time and eliminate the need for larger inventories of ready-made belts. Where

formerly inventories consisted of thousands of sizes and lengths for various V-drives, now almost all requirements can be reduced to small stock of the three most popular sizes of the new leather V-belt—A, B and C—which comes in rolls. These leather V-belts may be cut and made endless to any length for specific purposes right in the stockroom and in many cases directly on the pulley, using tools supplied by the company. *Chas A Schieren Co, 30-39 Ferry St, New York, N. Y.*

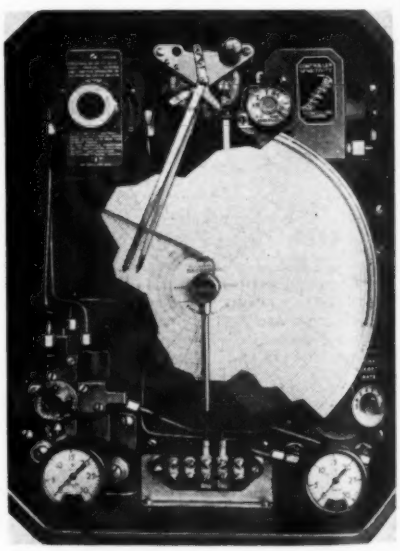


Packings

L-P-L-L PACKING in its simplest form consists of one or more elements of packing material *D, E, F* and *G* (see illustration), encircling the shaft and held in an offset or oblique position by the compression rings *A, B* and *C*. By offsetting the packing elements at an oblique angle in relationship to the shaft it follows that any surface of the shaft in frictional contact with the packing will, during the next half revolution, be free from contact with the pressure of the packing and in contact with the lubricant. During every revolution the shaft is alternately in contact with the packing or the lubricant. Part of the lubricant adheres to the shaft and is carried to the inner surface of the packing. A suitable lubricant is supplied through non-return fitting to a cavity in the upper part of the compression ring *C*. As the compression rings fit loosely on the shaft the lubricant spreads readily over the rotating surface. Where necessary a lantern ring *B* can be added to keep the lubricant from getting into the pump and contaminating the liquid. While the packing for low-pressure-sealing purposes consists of two compression rings with one packing element between them, higher pressures are provided for by increasing the number of packing elements and compression rings. This type of packing is said to prevent overheating because of its continuous supply of lubricant to the frictional surfaces, since it requires less power to rotate the shaft and prevents wear, scoring and replacement of the shaft. This packing is available and suitable for all sizes and conditions of refrigerating machines, pumps and propeller shafts. Where difficulty of installation in machines already in operation exists, the parts for the packings are made in sections to permit installation without dismantling the machine. *Gunby Machine Co, P O Box 5711, Main Post Office, Cleveland, Ohio.*

Automatic-Manual Unit for Process Controller

ON MANY APPLICATIONS it is more convenient to start up a continuous process on manual control and switch to automatic control as soon as process becomes stabilized. Whenever checking, inspecting or repairing of instruments is necessary, costly interruptions in processing or expensive standby equipment may be avoided if convenient manual control is possible. To meet this demand for supplementary control the company offers a new automatic-manual control unit with several improvements over former models. When the new unit is in manual position, controlling air pressures are also applied to the idle mechanism of the Fulscope controller which is thus maintained in constant balance with the process. Because of this balance, control can be changed instantly from manual to automatic without causing process disturbances. In addition to the three usual positions, "automatic", "manual" and "service" new unit contains a fourth step, "test". Set at "test", control is manual but full 20 psi supply pressure is applied to the instrument mechanism to make pos-



sible its complete and accurate readjustment without disturbing the position of the controlled diaphragm valve. The unit is designed to be installed

(*Continued on page* 168)

TIPS ON VALVE TRIM
TO HELP KEEP PIPING ON THE JOB
How to Repair Valves
11 SIMPLE WAYS TO GET BETTER SERVICE FROM PIPING EQUIPMENT
Short-Cuts to Faster Piping Jobs
FOR SPECIFIERS
FOR PIPEFITTERS
HOW TO KEEP YOUR PLANT GOING WITHOUT INTERRUPTION!
HELPFUL HINTS ON CHOOSING VALVES FOR BETTER PIPING SERVICE

Ask for as many sets as you need. Requests filled as received while supply lasts.

YOU'LL FIND 'EM IN "PIPING POINTERS"

What to do when a tee can't be had—a globe valve—or a needed reducer? How to get jobs completed despite materials shortages? How to help themselves in emergencies is what today's piping maintenance men must learn if vital production lines are to be kept flowing.

For practical examples of wartime piping ingenuity, see Bulletin 6 of Crane "Piping Pointers." In the hands of your maintenance men, veterans as well as trainees, this bulletin can do much toward preventing delays on piping jobs. Anyone can use the maintenance short-cuts and the safe hints it gives on substitution of materials.

SENT FREE TO ANY PLANT

Aimed at speeding the war effort by helping all industry get better service from valves, fittings and piping, "Piping Pointers" are based on Crane Co.'s 88-year background in flow-control engineering. Your Crane Representative will gladly supply copies of Bulletin 6 and others in the series. Or, write to Crane Co., 836 S. Michigan Ave., Chicago, Ill.

ARMY E NAVY

CRANE VALVES

BULLY . . .

We had our bully, too, just like any other shop, when I was serving my time as a machinist apprentice. He was a big bruiser, was Swanny, tipping the scales at over 200, and standing over six feet tall. He made life a constant agony for us apprentices with his tricks—greasing machine handles, spilling white lead over our tools, dulling our chisels, and doing everything else his devilish brain could figure out. He was too big for any of us to tackle, so he usually got away with it.

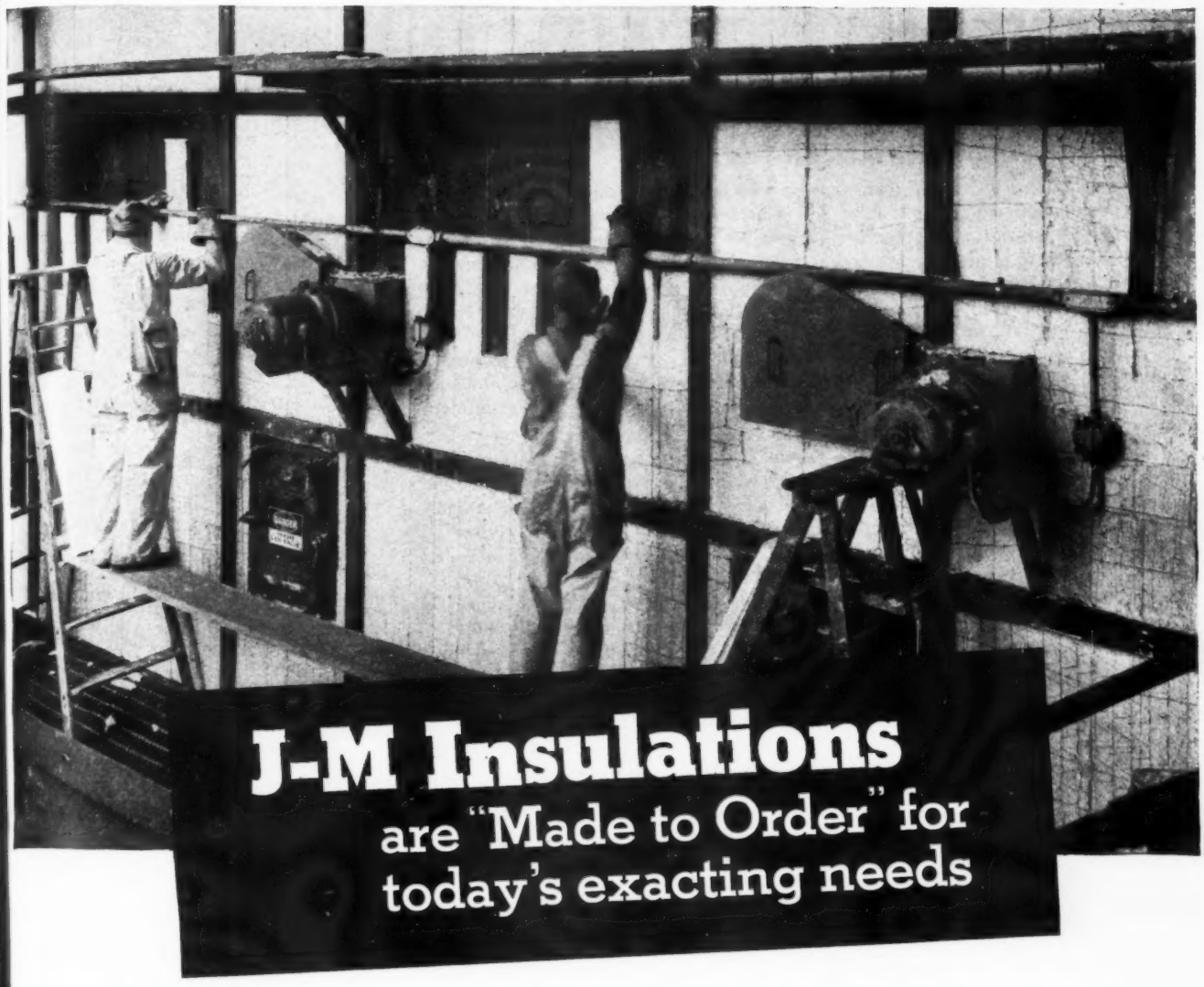
But once he called a little shaper hand an inexcusable name. The little guy walked over to Swanny with a small machinist's hammer in his hand. He was holding the head of it, and as he reached the bully, he rapped him hard on the jaw with the handle. He said, "You call me what you want; I no care. But you never call my mother a name again, or next time I use the other end, and hit you right between your eyes!" Swanny took it—the little fellow had a man-killing glint in his eye.

The other little fellow was a bench hand named Frank. He was so short he stood on a 12 x 12 block to do hammering at the bench. Yet he swung a 4-lb. machinist's hammer with a full-arm blow that I've never seen equalled by bigger men. Frank was a sober-sided man who rarely smiled anyhow, and he hated tricks while he was working. I remember the bawlings-out he gave me for fooling around at one time or another. I don't remember what Swanny was doing to Frank—throwing waste, or long curls of steel turnings, or some such thing. Suddenly Frank swung around on his block, and the rest of us looked up surprised when he called to Swanny; "Listen, you horse around too much some day! I no like it; in Old Country I see man die from fool stunt like you try. You bodder me just once more, and I do like dis to you!" With that, he flung his heavy hammer across the shop. It flew twenty feet or more and smacked a circular-saw blade, hanging on a nail, dead center with a terrific clang. Swanny never "boddered" *him* again either.

I mention these two cases because they both provide object lessons on the treatment of a bully. With help as scarce as it is, no boss can do much to give him his come-uppance; it must be done by the men, either singly or together. But every boss should know who the bullies are, and see that they don't break employee morale or cause accidents.

It is the bully who is the source of most practical jokes and horseplay. Taken in small doses, they help the crew work better. But the bully doesn't know what a small dose is. He goes on and on, creating increasing amounts of trouble, until somebody stops him, or somebody gets seriously hurt. Under today's conditions, horseplay doesn't cause accidents; it causes sabotage.

George Edwards
Engineer



J-M Insulations
are "Made to Order" for today's exacting needs

J-M Industrial Insulations cover every type of heat control. Each type of insulation is tailor-made to fit the particular job for which it was designed. In addition: Johns-Manville's 85 years' experience in every conceivable type of insulation problem makes it possible for J-M Engineers to design insulation applications for special conditions with utmost speed, thoroughness and economy. Following are just a few of the many types of J-M Industrial Insulations:

FOR TEMPERATURES TO 600° F. J-M 85% Magnesia has been for many years the most widely used block and pipe insulation for temperatures to 600° F. and, in combination with Superex, for higher temperatures. Maintains high insulating efficiency. Standard block sizes 3″ x 18″, 6″ x 36″ and 12″ x 36″; from 1″ to 4″ thick.

INSULATION FOR TEMPERATURES TO 1900° F. J-M Superex Blocks have long been standard for this service. High heat resistance, low thermal conductivity. Sizes 3″ x 18″, 6″ x 36″ and 12″ x 36″; from 1″ to 4″ thick.

FOR STEAM LINES UP TO 700° F. J-M Asbesto-Sponge Felted Pipe Insulation is recommended where maximum efficiency, high salvage and resistance to abuse are essential. For temperatures over 700°, used in combination with Superex. It is available in 3-ft. lengths, from 1″ to 3″ thick, for standard pipe sizes.

FURNACE INSULATION UP TO 2600° F. J-M Insulating Brick and Insulating Fire Brick are available in 7 types, with temperature limits ranging from 1600° F. to 2600° F. All provide light weight, low conductivity.

For details on these materials, and on the complete J-M Insulation line, write for Catalog GI-6A. Johns-Manville, 22 East 40th Street, New York, N. Y.

JOHNS MANVILLE JM PRODUCTS

Johns-Manville
INDUSTRIAL INSULATIONS

FOR EVERY TEMPERATURE . . . FOR EVERY SERVICE

POWER LINES

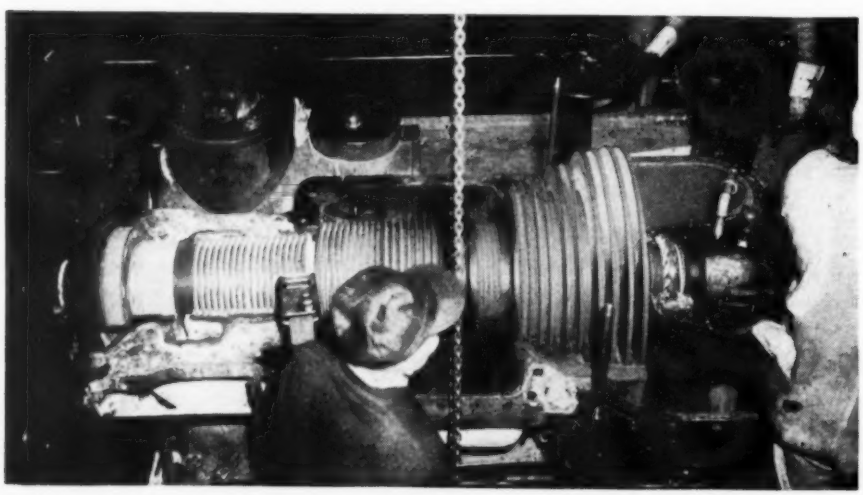
Personal notes, items of general interest, the latest from Washington:—all the news that is news in the power field

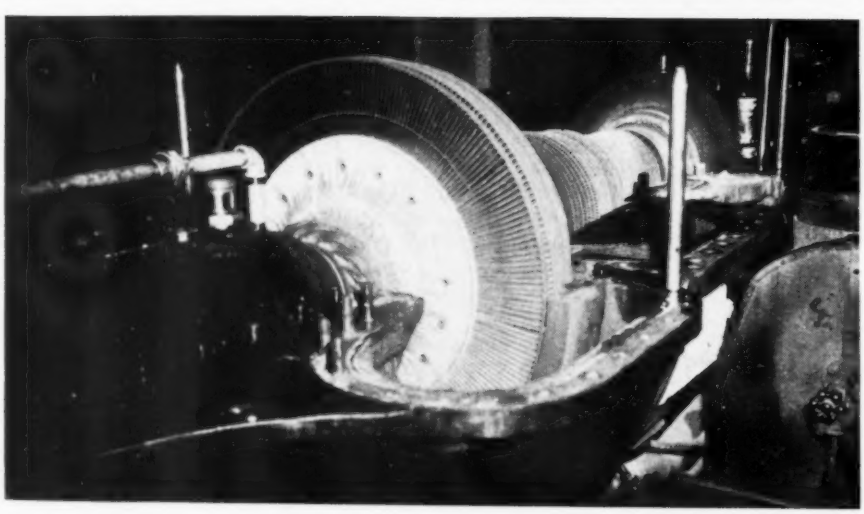
Turbine Needs No Repairs in 17 Years

A performance record of 17 years service without requiring a single repair part has just been completed by a 1750-kva Allis-Chalmers bleeding and mixed-pressure steam turbine operating at the Owens-Illinois Glass Co plant, Alton, Ill. The photos show the turbine opened up for its regular scheduled inspection and checking. It can be seen that the blading and other parts appear to be in excellent condition. With maintenance as important as it is today in wartime, the story of expert care behind this service record is as important as the turbine-operating record itself.

To utilize every advantage of the durability built into the turbine and generator, the company's power department crew rigidly follows a careful maintenance formula. Supervisor L R Mohler credits the fundamental but vitally important steps with the success of their maintenance efforts:

1. Keep conditions in the boilers as nearly ideal as possible, eliminating water and impurities from the steam. By doing this you relieve the turbine of a lot of grief it never was intended to take and at the same time you cut maintenance cost and increase the reliability of the turbine.
2. Inspect and clean the turbine regularly, to avoid accumulation of grit and dirt that may cause unnecessary wear or other bad effects.
3. Lubricate all working parts systematically, using a high-grade turbine oil recommended by the turbine manufacturer, in the circulating system. Periodically check the lubricant to make sure that it does not become contaminated in any way.
4. Filter the generator cooling air through glass filters to keep the winding and ventilating ducts clean. When this is done oil and other substance detrimental to electrical insulation is kept off the windings. Windings operate at lower temperatures when they and the air ducts are clean. Keeping deteriorating elements off the windings and reduced temperatures, spell long insulation life.





POWER on Time?

War has affected everyone, and we're no exception. Copies of POWER are mailed from Albany, and although the nation's transportation system is functioning excellently, circumstances occasionally disrupt the best-laid schedules. So, if you're annoyed because POWER arrives a day or so after it should, please refrain from damning the editors and publishers, and bear with us until the fight is won.

OBITUARIES

Arthur G Shelley, Washington representative of **Combustion Engineering Co** died April 28 in his 53rd year. Mr Shelley became associated with Combustion Engineering Co in September, 1933, following an experience of some 22 years in the erection, operation and sale of stokers.

Ludwig Kallir, retired chairman of the board of directors and chief engineer of the A E G Union Electric & Mfg Co, Vienna, Austria, died Jan 7, 1943, in London, England. He was 68 years of age. Mr Kallir had been prominently identified with power generation, transmission and distribution in Central Europe for more than 40 years. He was a member of the committee of action of the International Electrical Commission and the chairman of the committee for standard specifications of the Austrian Institute of Electrical Engineers. He represented his country at many international conferences as an official delegate, and as such spent some time in this country during the 1936 World Power Conference. Best known among his many papers and articles in the technical press and in the transactions of engineering societies was his contribution on "Power Transmission" in the well-known European handbook on electrical power edited by Rziha and Seidener. He was a member of the American Institute of Electrical Engineers, the Institution of Electrical Engineers (London), the Swiss Institute of Electrical Engineers, the International Conference on Large High-Voltage Systems (CIGRE) in Paris, the Austrian Illuminating Society, and a former

(*Continued on page* 190)

THE SCIENTIFIC APPROACH TO YOUR PIPING PROBLEMS

POWER PIPING FUNCTIONAL HANGERS

This simple type of Functional Hanger fulfills the requirements expressed by 85% of the entire present day use for spring hangers and is particularly adaptable to low headroom conditions . . Functional Hangers are furnished in seven types for every piping installation requirement including shipboard use.

These standard products save thousands of man hours in Design, Fabrication and Erection of Piping Systems

VIBRATION ELIMINATORS

Permit swivel action in all directions.

Provide means for obtaining and holding the desired degree of force in opposition to vibration. Operate with a minimum of spring action. Spring tension can be adjusted at will.

POWER PIPING DIVISION PRESENTS THE ULTIMATE IN ENGINEERING-PREFABRICATION AND ERECTION OF PIPING SYSTEMS

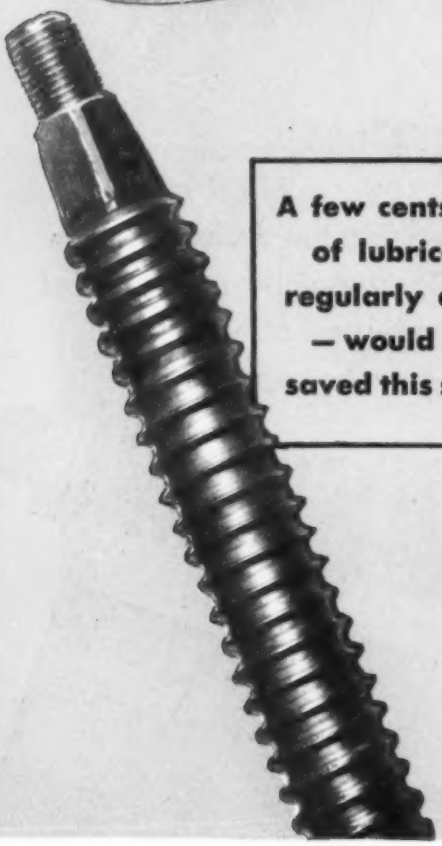
BLAW-KNOX COMPANY
POWER PIPING DIVISION
1525 PENNSYLVANIA AVE., PITTSBURGH, PA.

The correlated use of FLEX-ANAL CHARTS and HANGER BULLETIN 1863 saves time in engineering man power which can be devoted to other useful purposes. Copies of these books can be obtained through a request on your business letterhead.

Prevent Valve Failure

ABRASIVE WEAR

ruins a Yoke Sleeve
-forces a Shutdown-
when lubrication is neglected



A few cents worth of lubrication regularly applied — would have saved this spindle

Because regular lubrication was neglected, this yoke sleeve from an O. S. and Y. Gate Valve wore out rapidly and failed in service. Important plant operations were stalled when the line was shut down to make the necessary replacement.

As the illustrations indicate, the original sturdy flange on the base of the yoke sleeve (or bushing) was reduced to a wafer-thin "washer" by abrasive wear, and then it sheared off. Since the (yoke sleeve) flange must withstand the entire thrust when the valve is tightly closed, and also when the valve is back seated in the fully open position, it is extremely important that its original strength be maintained by proper lubrication and care.

"Hit or miss" lubrication schedules also take their toll of outside spindles, as illustrated at left. Threads left dry and unprotected are worn by grinding grit on the thread bearing surfaces, threatening sudden failure and injury to operatives, as well as damage to property.

JENKINS VALVES

before it starts!

Lubricate Valves on Schedule

-at least once a month- to prevent such failures

Jenkins Iron and Steel O. S. and Y. Gate Valves are made with a drilled hole in the yoke cap to supply oil to the moving parts. On the larger size valves, a grease gun fitting is provided in place of the oil hole.

Valves should be lubricated on strict schedule, at least once a month, more often when they are operated frequently. At the same time, outside screw threads should be thoroughly cleaned and lubricated. When abrasive dust conditions are especially severe, improvised protective tubing, booting, or telescoping sleeves should be used.

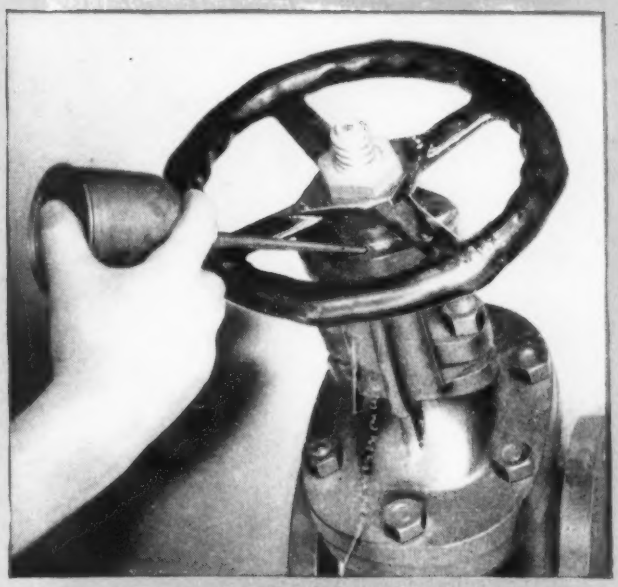
• • •

For many plants today, valve repair parts are simply unobtainable. And in war production plants, whose priority allows their purchase, such needless valve failure represents inexcusable waste of critical metals. Most serious is the lost production, which may hold up the delivery of urgently needed war materiel to our armed forces.

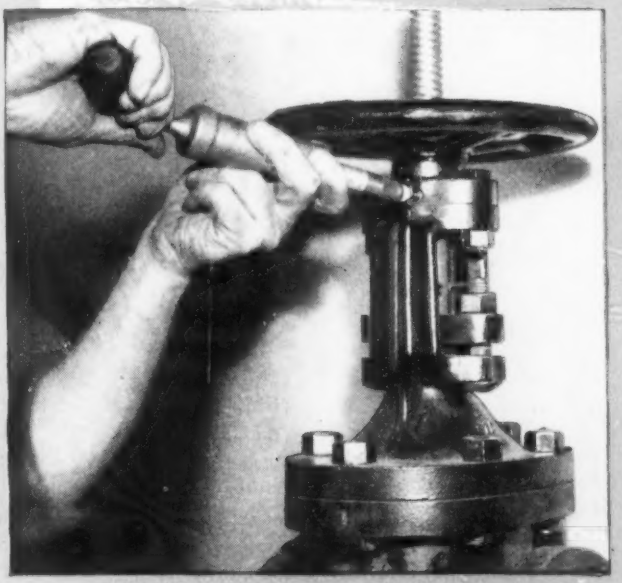
Needless valve failure *can* be prevented. Inspect valves frequently, systematically. Repair or replace worn parts in time to prevent valves from destroying themselves. See that new valves are carefully selected, installed by experts. And train new men thoroughly in care and maintenance.

Jenkins Engineers will assist any management in preparing an effective program of valve conservation upon receipt of details of present valve problems.

Jenkins Bros., 80 White Street, New York, 13, N. Y.; Bridgeport; Atlanta; Boston; Philadelphia; Chicago. Jenkins Bros., Ltd., Montreal; London.



Jenkins O. S. and Y. Gate Valves in smaller sizes are made with an oil hole in the yoke cap. Lubricate them regularly.



Larger Jenkins O. S. and Y. Gate Valves are equipped with a grease gun fitting. Grease them frequently, systematically.

For every industrial, engineering, marine and power plant service

BRONZE ★ IRON ★ STEEL

Number 131

How to Pack a Stuffing Box

1. Remove all old packing from the stuffing box.

2. Clean box thoroughly, removing accumulations from walls.

3. Keep packing clean during application. The scoring of rods, shafts or sleeves often results from grit or foreign matter picked up by packing.

4. Determine size of packing required by checking diameter of rod or shaft and the inside diameter of the stuffing box. Rods wear and the packing has to compensate for this wear.

5. Never wind a length of packing into a stuffing box. Use ring form only.

6. Cut spiral or coil form packing over a shaft or mandrel of exactly the same size as the one on which the packing is to be used in order to get close fitting rings.

7. Obtain sharp clean cuts on soft packings that tend to squash or become ragged by simply applying a small piece of friction tape at the place where the packing is to be cut. It is advisable to remove the tape when installing the rings. String also serves well for tying the packing on each side of where the cut is to be made and may be left on the packing when installed.

8. Cut all packing ring joints to a snug fit making the rings meet with a tight butt or bevel joint.

9. Seat each packing ring carefully before placing the next one in the box. Loading a stuffing box with packing and then pulling up on the gland follower may cause excessive deformation of the first two rings, building up localized gland pressure and failure to seat the bottom rings so they can work effectively.

10. Install all packing rings so that joints are staggered and kept approximately 90 deg apart. Spot joints in clockwise direction to facilitate locating them when removing packing.

11. Pull up the gland follower sufficiently tight, after the packing has been installed, to insure final seating of the packing. The nuts should be backed off two or three turns to relieve excessive pressure. Adjust packing to operating conditions.

12. Keep the following in mind for stuffing boxes provided with water, oil or grease lanterns: (a) Make sure that the lantern is so located in the box that as the packing is taken up, the lantern will be advanced to its proper location with respect to the opening in the box. (b) Check to see that the opening into the stuffing box is free from obstructions so that the sealing water or lubrication can flow into the lantern.

13. Allow packing to leak a small amount, if possible, when starting a newly packed pump. Take up the gland slowly as the packing seats.

14. Provide means for lubricating the rod and packing wherever possible.

15. Finally, carefully wrap all extra packings, place them back in their container as a precaution against waste and the possibility of their picking up dirt and other injurious foreign substances.

Helpful Hints for Handling Packings

1. Use packings of correct size. Oversize packings are difficult to install and may cause excessive friction. Undersize packings may be ruined by too much takeup.

2. Where leakage cannot be permitted, provide a means of introducing a sealing or lubricating fluid such as water, oil or grease into the stuffing box.

3. When renewing packings, use all new, clean packing. Worn packings are dry, highly compressed, have high friction, may develop scoring.

4. Remember packing is relatively cheap. Labor and materials necessary to replace worn shafts, sleeves or rods are expensive and critical commodities.

5. Take up bolts evenly, moving to the bolt diametrically opposite, never to the bolt adjacent.

6. Follow up bolts the next day after installing new gaskets. For lines carrying high pressures, the gradual building up of the pressure and continuous follow-up of bolts is recommended.

7. Exercise great care when using gasketing dopes. Never use oil or grease on a rubber or rubber-compounded gasket. Graphite and glycerine or molasses compounds are not injurious to rubber. Never use dope on both sides of gasket—it may cause slippage or blowout.

8. Do not use a heavier sheet packing than is necessary. The thinner the gasketing material, the better.

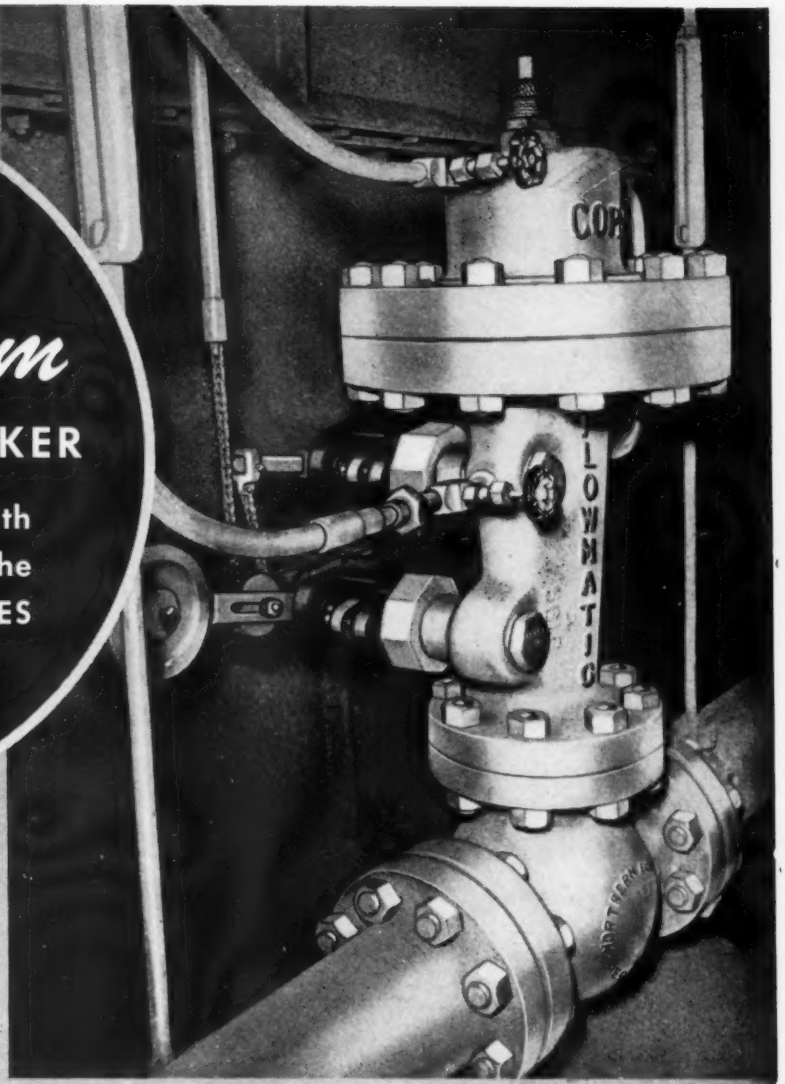
9. Ring gaskets are preferable to full face gaskets where the flanges are heavy enough to prevent distortion.

Courtesy Johns-Manville Corp

© POWER

NO *Absenteeism* FOR THIS WAR WORKER

168 hours every week with no lost time! That's the record of thousands of COPES Feed Water Regulators.



▲ This direct operated COPES Flowmatic Regulator Valve feeds a 600-pound pressure Vogt Boiler; 90,000 pounds per hour capacity.

ON both land and sea, COPES Feed Water Regulators perform their war jobs consistently and thoroughly. They make boiler operation SAFER, by stabilizing water level within fixed limits. They increase efficiencies of boilers, heaters and pumps; steady the steam pressure, and increase peak capacities. Important at any time, these tasks become doubly so during War.

Why COPES Regulators Stay on the Job

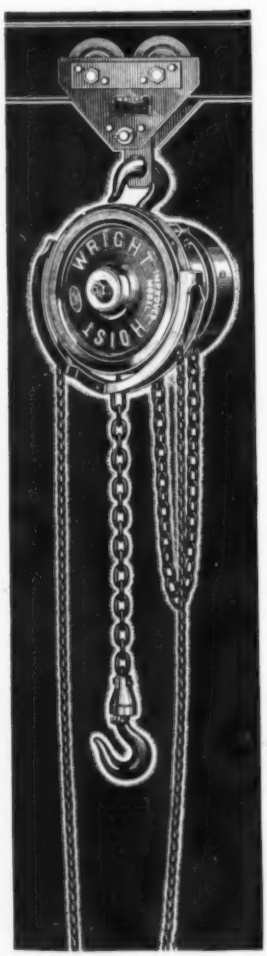
1. *SIMPLE*—Design based on proven mechanical principles that won't fail.
2. *FAST*—Responsive to level changes 5 to 8 times faster than others tested. Speed available where needed.
3. *DEPENDABLE*—Built for hard service and little attention.
4. *SELECTIVE*—Both single element and two element regulators are available, with Thermostats and Valves designed for the specific application.

Write for catalog 12-41.

NORTHERN EQUIPMENT CO • 731 Grove Drive, Erie, Pa.
FEED WATER REGULATORS . . . PUMP GOVERNORS . . . DIFFERENTIAL VALVES
LIQUID LEVEL CONTROLS . . . . REDUCING VALVES AND DESUPERHEATERS
Branch Plants in Canada, England • Representatives Everywhere

OVER 60,000 COPES FEED WATER REGULATORS IN SERVICE

★ GET CLOSER LEVEL CONTROL-WITH THE COPES FEEDS BOILER ACCORDING TO STEAM FLOW-AUTOMATICALLY FLOWMATIC ★ REGULATOR



WRIGHT HOISTS are built to carry more than their rated capacities, but like other well-made pieces of mechanical equipment they should *not* be overloaded. Overloading is dangerous to men and imposes excessive strain on the hoist. Certainly, this is no time to take chances with either men or machines.

Watch the load hook. Wright load hooks are drop-forged from special steel which, when subjected to overloading, give visible warning by opening slowly. When the load hook has started to open, look to the top hook too, for while it is stronger than the bottom hook, it also may be reaching a danger point. When hooks show the effect of overloading, replace them immediately with new ones. Remember: repair parts are both easier and cheaper to get than a complete new hoist.

Send today for a free Crane Signal Chart. This chart (36" x 24") may be hung on the wall or tacked on a bulletin board. It illustrates the various crane signals in a simple manner—and the use of the Wright system of crane signals will speed crane operation and promote safety. Write for your chart today. It is free of either cost or obligation.

WRIGHT MANUFACTURING DIVISION
York, Pa., Chicago, San Francisco, New York
AMERICAN CHAIN & CABLE COMPANY, INC.
BRIDGEPORT, CONNECTICUT

In Business for Your Safety

Eugene, Oregon

(*Continued from page 66*)

feedhole located somewhat nearer the bridge wall than the front wall. Main grates, 8 ft 6 in. wide by 10 ft 6 in. long, have an additional 9 in. of grate area at the front, as well as the ventilated place at door opening to provide overfire area. Oven has a height of about 7 ft. and is divided into three cells by 13-in. partitions, extending nearly to the flat supported arch that forms the cells' ceiling. The conventional furnace nose is formed by chrome ore packed between the tubes that form the waterwall of the boiler.

Area of the Beecher grates is 89.75 sq ft. They consist of well-ventilated fingered sections, each having a fuel-supporting surface 4½x9 in. with about 30% of the area in air openings each approximately ⅜ in. wide. Blocks have two concave surfaces on their underside cast to the curvature of standard 1½-in. pipe against which they clamp by means of ⅝-in. bolts and fittings. Heat absorption rate of this water-cooled grate is 12,000 Btu per sq ft at full load. Each cell contains 250 ft of 1½-in. pipe in series through which 35 gpm of water circulates.

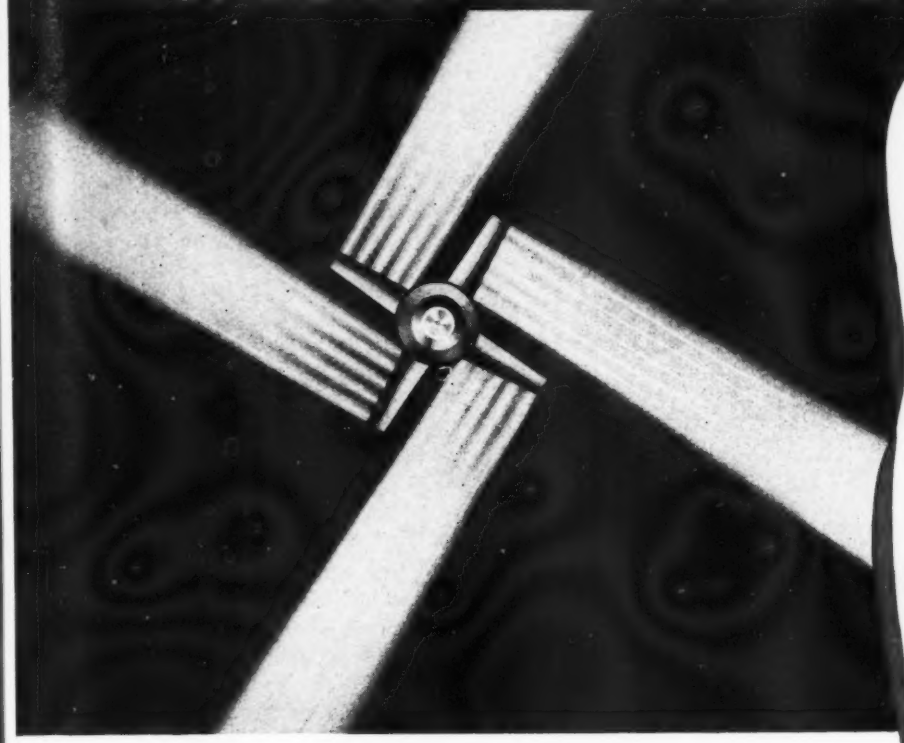
Grate Water Condensate

Except for emergency use, grate water is condensate, varying from 100 F to 225 F inlet temperature. When failure of the grate-water pump or interruption of condensate supply from the turbine or stored water from the heater occurs, firemen admit city water manually when an alarm sounds or outlet thermometers indicate excessive temperature.

In the interval between buying and installing the boiler, we decided to install a cinder collector for two reasons: (1) The boiler manufacturer had allowed a loss of nearly 5% in the heat balance largely for unconsumed carbon losses, and (2) we knew that considerable flyash discharge would normally occur from furnaces operating at the combustion rate required at higher capacities.

We installed a dry-type cinder collector, manufactured by the Western Precipitation Corp. It consisted of two essential parts—*skimmer* and *multiclone*. Cinder-laden gas enters the multiclone tubes through a vane where the gas receives high rotational velocity and the cinders are thrown to the tubes' outer periphery. Outer layer of gas, which is 5 to 10% of volume, is

A BOOST FOR BUSY BOILERS...



THRU-PUT CAN BE INCREASED BY MORE COMPLETE COMBUSTION — WITH FANMIX

"Pinwheel Action"

Your gas fired boilers are not operating at maximum load possible, if you haven't yet installed the new gas burner that produces a perfectly combustible mixture of air and gas.

With a Coppus-Dennis FANMIX on the job, you get much greater heat release per cubic foot of furnace volume. Gas escaping from radially spaced orifices in the driving arms rotates the fan; causing in-take of air at right angles to the path of the gas.

The energy in gas under pressure is utilized to perform work by mechanically mixing and proportioning the gas with just the proper amount of air, thus eliminating from the furnace the necessity of serving as a mixing chamber as well as combustion space.

Ignition is instantaneous, and combustion is so complete that no flame is visible. A constant temperature exists throughout the furnace — there are no drifting "hot spots". On new equipment, FANMIX saves combustion space, stack height and the cost of forced draft equipment.

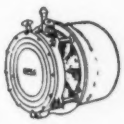
Write for free Booklet 410-3 describing other exclusive fuel-saving, equipment-saving advantages of Coppus-Dennis FANMIX Gas Burners — a Coppus "Blue Ribbon" product.

COPPUS ENGINEERING CORPORATION
307 Park Avenue, Worcester, Mass.

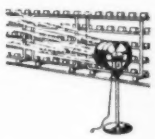
You'll get valuable ideas from these free bulletins on other Coppus Blue Ribbon Products

(Check the ones you want)

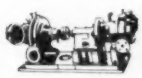
☐ Coppus Air Filters. For engines and air compressors. Perfect, uninterrupted filtration. Bulletin F-310-4.



☐ Coppus Type C Turbo Blower. For undergrate draft. Bulletin 145-6.



☐ Coppus Heat Killers. High speed blasts for cooling and drying furnaces, motors, generators, products, etc. Bulletin 160-5.



☐ Coppus Steam Turbines. 6 sizes (and prices) from 150 H.P. down to fractional. Bulletin 135-9.

☐ Coppus Cable Manhole and Tank Ventilators. For confined working spaces. Bulletin 163-1.

☐ Coppus-Dennis Fanmix Gas Burner (described in this ad).

Name .....

Company .....

Address .....

City ..... State .....

Sales offices in THOMAS' REGISTER.

Other "Blue Ribbon" Products in SWEET'S.

COPPUS

COPPUS BLUE RIBBON PRODUCTS DESIGNED FOR YOUR INDUSTRY . . . ENGINEERED FOR YOU

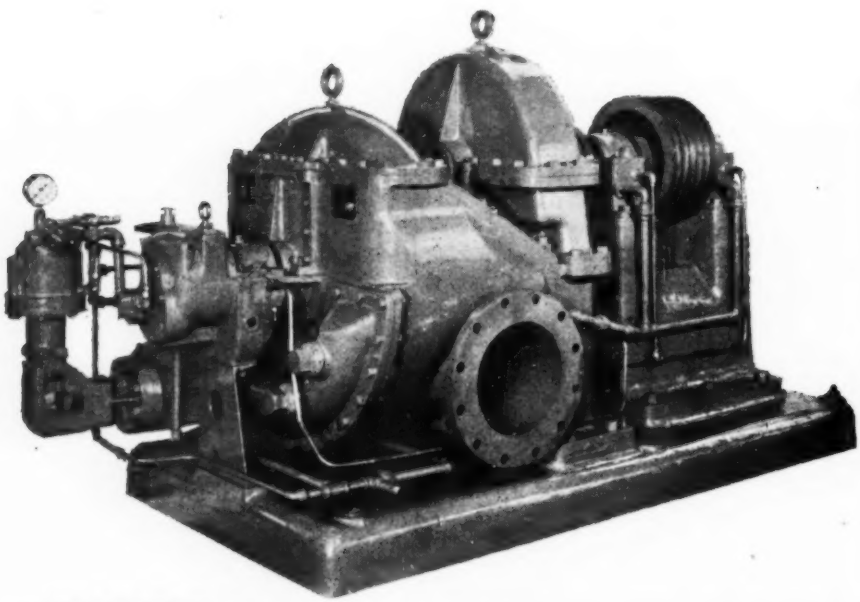
MURRAY

BOILERS . . . . . TURBO GENERATORS
MECHANICAL DRIVE TURBINES
ENGINES . . . UNIT HEATERS . . . GEARS

TYPE UG
INTEGRAL GEARED TURBINE

• Type "UG" Integral Geared Turbine consists of the Type "U" Mechanical Drive Turbine with integral single or double helical reduction gear. Turbine is supported by the gear at the turbine shaft centerline thereby avoiding misalignment due to the heating of the turbine casing.

View shows unit equipped with variable speed direct acting oil pump governor and extended low speed shaft with sheave for V-belt drive.



MURRAY
IRON WORKS COMPANY
INCORPORATED 1370
BURLINGTON IOWA

skimmed off at the tube ends by the multiclone fan.

The multiclone proper consists of twelve small cyclones in parallel through which the skimmed gas passes. Pressure drop through the cyclones and the connecting duct is corrected by a 15-hp motor-driven fan. The cleaned gas returns to the flue duct ahead of the induced-draft fan. The separated cinders drop from a hopper and are then spouted into the combustion chamber where they are consumed. The collector was guaranteed to remove at least 95% of the material leaving the boiler that had a fineness of 200 mesh and larger.

Guaranteed boiler performance applied to half its nominal rating, although it was also guaranteed to evaporate 120,000 lb of water per hr from wood fuel with a moisture content of 47%. General results of the acceptance test at that rating are shown in the table. All tests were run with operating crews who were without exception inexperienced in handling wood fuel. All fuel loads were weighed over testing scales; each contained from one to four units, separately sampled for moisture determination. Check moisture samples were taken at the feed chutes every 20 min of the test run. Turbine condensate was measured through a calibrated meter.

Bled-steam Weights

Bled-steam weights and auxiliary steam were determined by computation. Performance of boiler, turbine and related equipment has been very satisfactory. The turbine-generator has carried loads in excess of 9000 kw at system power factor for extended periods without the least difficulty. The boiler furnishes sufficient steam from wood fuel to carry 11,000 kw, using both turbine-generators. Capacity would undoubtedly be much greater with oil fuel but we have done little test work because of oil restrictions.

The cinder collector proved efficient with minor changes in ducts and related parts, made after several test runs. One contributing cause of cinder fineness is the fact that flue gas must pass through the 2½-in.x14-ft air-heater tube banks twice before reaching the skimmer. Rate of cinder discharge is, of course, greatly influenced by fuel fineness and boiler rating.

While the boiler is on bank, tars from the slow-burning fuel accumulate on cold metal surfaces. To keep this accumulation from the air-heater tubes, air supplied to the banked fire comes directly through the ashpit doors instead of coming through the air heater

TUBE-TURN WELDING FITTINGS—RANGE OF SIZES

Type of Fitting	Description	Standard Weight	Extra Strong	Schedule 160	Double Extra Strong	Light Gauge Nominal Pipe Size	Light Gauge Iron Pipe Size
Elbows	90° Long Radius	½"-24"	¾"-24"	1"-14"	1"-8"	4"-24"	3"-12"
Elbows	90° Short Radius	1"-30"	1½"-30"				
Elbows	45° Long Radius	½"-30"•	¾"-30"•	1"-14"	1"-8"	4"-24"	3"-12"
Returns	180° Long Radius	½"-24"	1"-24"	1"-14"	3"-8"	4"-24"	3"-12"
Returns	180° Short Radius	1"-30"	1½"-30"				
Returns	180° Extra Long Radius	1"-2½"	1"-2½"				
Tees	Straight	½"-24"	½"-24"	1"-12"	1"-8"		
Tees	Reducing Outlet	¾x¾-24x20	¾x¾-24x20	¾x¾-12x10	1x⅜-8x6		
Reducers	Concentric & Eccentric	1x⅜-24x20	1x⅜-24x20		1x⅜-8x6		
Caps		¾"-24"	¾"-24"		1"-8"		
Stub Ends	Lap Joint	¾"-24"	¾"-24"				
Nipples	Shaped, 90° to Header	1¼"-12"	1¼"-12"				
Nipples	Shaped, 45° to Header	1¼"-12"	1¼"-12"				
Saddles		2"-24"					
Laterals	Straight	1¼"-24"	1¼"-24"				
Laterals	Reducing	1¼"-24"	1¼"-24"				
Crosses	Straight	¾"-24"	¾"-24"				
Rings	Welding	¾"-12"	¾"-12"				
Sleeves	Welding	2"-24"					

•30" size short radius.

SUPER Tube-Turn 45° long radius elbows, 90° long radius elbows, and 180° long radius returns available in both Standard weight and Extra Strong in sizes from 3" to 12".

Tube-Turn welding fittings and flanges conform to applicable ASA and ASTM Standards. For further details please refer to Tube Turns catalog and data book No. 111.

TUBE-TURN FORGED STEEL FLANGES—RANGE OF SIZES

	150 Lb.	300 Lb.	400 Lb.	600 Lb.	900 Lb.	1500 Lb.	2500 Lb.
Welding Neck	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"•	½"-24"	½"-24"
Slip-On	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"•	½"-24"	½"-24"
Lap Joint	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"•	½"-24"	½"-24"
Threaded	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"•	½"-24"	½"-24"
Blind	¼"-24"	¼"-24"	½"-24"†	½"-24"	½"-24"•	½"-24"	½"-24"
Socket Type	¼"-24"	¼"- 4"		¼"-3½"			
Reducing-threaded or slip-on	¾"-24"	¾"-24"	¾"-24"	¾"-24"	¾"-24"	¾"-12"	¾"-12"
Orifice—threaded		1"-24"	4"-12"	4"-12"	3"-12"	1"-12"	
Orifice—slip-on		1"-24"					
Orifice—welding neck		1"-24"	4"-12"	1"-12"	3"-12"	1"-12"	
Long Welding Neck	1"-24"	1"-24"	1"-10"	1"-10"	1"-10"	1"-10"	

†Dimensions on sizes thru 3½" same as for 600 lb. flanges.
•Dimensions on sizes thru 2½" same as for 1500 lb. flanges.

TUBE - TURN
TRADE MARK
Welding Fittings and Flanges

The ★ FIRST WELDING FITTINGS 1ST AND STILL THE BEST

TUBE TURNS (INC.) LOUISVILLE, KY. *Branch offices*: New York, Chicago, Philadelphia, Pittsburgh, Cleveland, Dayton, Washington, D. C., Houston, Los Angeles. *Distributors in principal cities.*

ARE YOUR BOILERS SAFE FROM

OXYGEN CORROSION?

EVEN if you feed distilled water into your boiler system . . . even if your plant is protected by efficient mechanical deaeration . . . there is always the danger that overloads or leakage of air into the system may cause oxygen corrosion.

Your best protection against that danger is continuous treatment of your boiler feed water with Santosite.

For positive protection, maintain about thirty parts Santosite per million parts water in your system at all times. One simple test at regular intervals will give you an accurate check on the system . . . and will reveal any new leakage of oxygen by an abrupt drop in the Santosite concentration.

An anhydrous, crystalline product, Santosite is easy to handle, store and apply. Depending on the oxygen content of the feed water, costs of continuous, dependable protection against oxygen corrosion vary from $0.05 to $0.65 per million pounds of boiler feed.

For full details on Santosite and its application to your boiler system, write: MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, St. Louis, Mo. District Offices: New York, Chicago, Boston, Detroit, Charlotte, Birmingham, Los Angeles, San Francisco, Montreal, Toronto.

SANTOSITE

POSITIVE PROTECTION AGAINST OXYGEN CORROSION

MONSANTO CHEMICALS

SERVING INDUSTRY...WHICH SERVES MANKIND

"E" FOR EXCELLENCE—The Army-Navy "E" burgee with two stars, "representing recognition by the Army and the Navy of especially meritorious production of war materials" over a two-year period flies over Monsanto.

where entering cold air might chill the tubes.

The Eugene Municipal Electric System now has about 9000 kw of net hydro energy, dependent on a transmission line but available throughout the year, together with 14,000 kw of steam-driven generating equipment available for its system peak of about 13,000 kw. A tieline connection with the Bonneville system provides dump and emergency power exchange. The connection has been mutually helpful several times when one or both systems experienced trouble.

Cost of steam-generated energy from the new unit has been substantially as estimated, although wood-waste cost has been considerably greater than anticipated. On a design basis, the new installation's cost per kilowatt of capacity is a little greater than the first unit's. However, cost per kilowatt of energy actually available is considerably lower than the first unit's. There is a real advantage in having a standby plant located inside the city limits and generating at distribution voltage so that service does not depend entirely on transformers or transmission lines.

Compressed Air

(*Continued from page* 81)

ing receivers in the system where the air is used.

Q 12—Why doesn't a compressor give a sufficiently high pressure at times?

A—The reason is obvious. Air is used in greater volume than the machine produces. In such cases, additional compressor capacity solves the problem.

Q 13—Why do operators sometimes say that compressor capacity has apparently fallen below that formerly obtained?

A—When compressor valves, either suction or discharge, have been removed for cleaning or inspection, take extreme care not to install them upside down. These valves, frequently made interchangeable between suction and discharge, should be stamped to indicate which side must be toward the piston when used in either location. If valves are incorrectly installed, the compressor may unload itself, or it may even be possible that air cannot get out of the cylinder. In the latter case, serious damage results.

Q 14—Why does the cylinder get so hot that you cannot hold your hand

Edward 12 in. 1500 lb cast steel stop valve with Impactor handwheel shows gamma ray negatives completely encircling welding ends. Body markings indicate locations of negatives during radiographic examination of other areas. Unique radium capsule fixtures of original Edward design facilitate production inspection.

How Radiography Protects Users of EDWARD CAST STEEL VALVES

RADIOGRAPHIC EXAMINATION is a standard inspection procedure for Edward cast steel valves.

Every gamma ray negative, carefully identified with the exact area of the exact valve it pictures, is filed as a permanent case history of individual valve soundness.

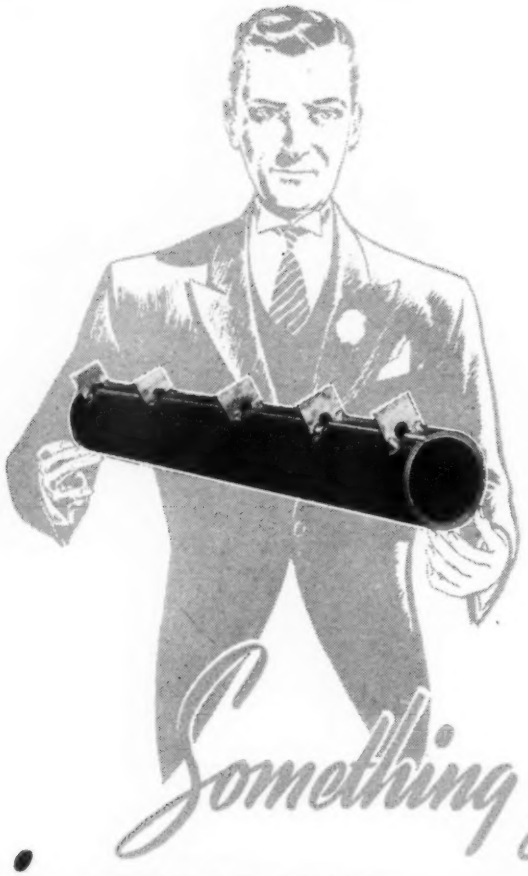
Edward metallurgists pioneered the gamma ray examination of steel valve castings. Through the years they have acquired the interpretative skill that can be gained only through the experience of making and reading thousands of negatives.

The lessons they have learned are reflected in advanced foundry techniques, and progressively better valve design.

This is just one—but a very important one—of the many extra precautions that make Edward extra value valves.

THE EDWARD VALVE & MANUFACTURING CO., INC.
1220 W. 144th STREET • EAST CHICAGO, INDIANA

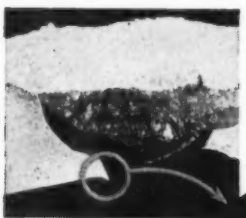
EDWARD
Steel CAST AND FORGED
VALVES



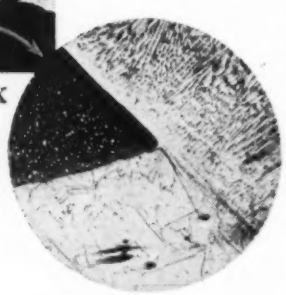
Something Special

in WELDING, perhaps?

As the science of welding metals progresses, many interesting and unusual problems develop. So that accuracy and thoroughness may be established as fact on jobs of special character, Associated employs full use of scientific checks. The photographed section of pipe shown above is a fabrication made from nickel clad steel. On this particular job the problem was to insure that the deposit of pure nickel in the base of each weld be not less than the thickness of the original clad nickel at all fluid contact surfaces. This work was checked with macrographs as well as photo micrographs.



Magnification 10X



Magnification 100X

Macrograph shows pure deposited nickel at base of weld before any alloying. Photo micrograph in circle shows characteristics of deposited pure nickel, of original clad nickel, of original steel to which nickel was clad.

Perhaps you have a problem which requires something special in welding. Associated is equipped in every way to assist.

WAR PRODUCTION . . . This company is engaged in high priority war production, proud of its responsibilities and fulfilling them to the letter.

ASSOCIATED PIPING & ENGINEERING COMPANY

2332 EAST 38TH STREET

LOS ANGELES, CALIFORNIA

against its surface? (This is a rather frequent inquiry.)

A—Compressed air or gas obviously heats rapidly. When compressed to 100 psi, temperature may exceed 300 F, depending upon the cylinder's size. This is not excessive. You cannot hold your hand in water at 150 F, so this condition does not in itself mean that the cylinder is too hot or that anything is wrong internally.

Kentucky School

(*Continued from page* 83)

them—for example, Walter J Crum, electrician at the Solvay plant. Walt is typical of the men in the plants thereabouts except that he had a bit more schooling than the average—grade school, part of high school and an electrical course in ICS. He told me the men in Mr Coughlin's course were sticking to it because of value received.

Walt's job at Semet Solvay has to do with the pumps, motors and generators. Solvay was putting in a lot of motor-driven units. That was why Walt was particularly interested in the announced subject for the next class—lining up a pump and its drive.

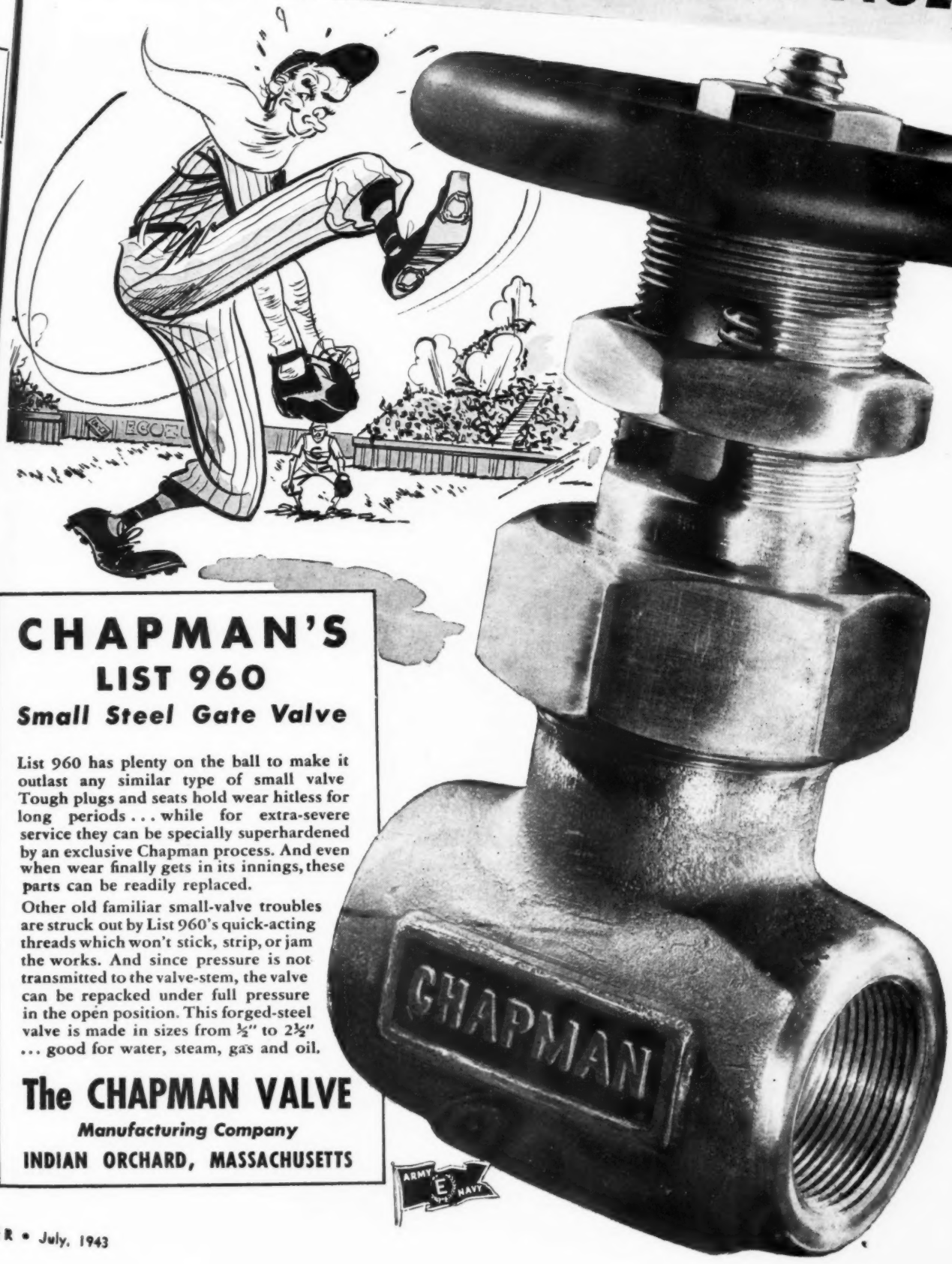
Quite different was the case of George Yancey, Jr, Ashland Oil and Refining Company, Industrial Sales Department. George was a Bachelor of Science in Chemistry (University of Kentucky and Marshall College, Huntington, W. Va.). He had about 2½ years of laboratory and research work at the refinery and figured on being an oil salesman some day. This course was teaching him to talk the language of the plant men he will meet later.

Next, Clyde Trivett, Armco steam power maintenance man, tackled me with such enthusiasm that I asked him to write an article for POWER showing how he gets a precision lineup between a pump and the driving motor. Inspired by Boss Coughlin, Clyde has gone "all out" in this matter of alignment. Nothing worse than two thousandths will satisfy him, and he works only with dial indicators and a special set of clamps he built to fit all types of couplings and shafts.

I can't move away from this schoolroom without mentioning George's father, J J Coughlin. A retired steam engineer, 79 years old, the senior Coughlin hadn't missed a class—seemed well satisfied with his son's talents.

The father was one of the NASE pioneers, was well known to POWER's

STAYS IN THERE PITCHIN' LONG PAST "RETIREMENT AGE"



CHAPMAN'S
LIST 960
Small Steel Gate Valve

List 960 has plenty on the ball to make it outlast any similar type of small valve Tough plugs and seats hold wear hitless for long periods . . . while for extra-severe service they can be specially superhardened by an exclusive Chapman process. And even when wear finally gets in its innings, these parts can be readily replaced.

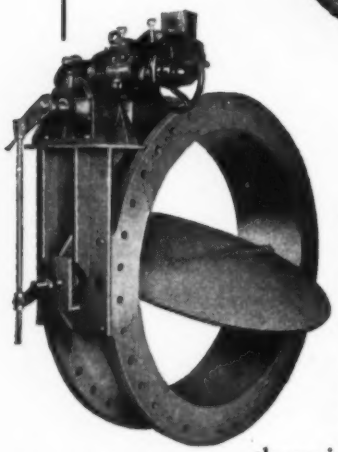
Other old familiar small-valve troubles are struck out by List 960's quick-acting threads which won't stick, strip, or jam the works. And since pressure is not transmitted to the valve-stem, the valve can be repacked under full pressure in the open position. This forged-steel valve is made in sizes from ½" to 2½" . . . good for water, steam, gas and oil.

The CHAPMAN VALVE
Manufacturing Company
INDIAN ORCHARD, MASSACHUSETTS

Easy to Operate...

Streamlined for Self-Cleaning

16-inch cast iron chain wheel operated valve for pressures up to 15 pounds. Complete range of sizes from 2-inches to 84-inches.



Automatic electric-motor operated American Standard Valve with hand wheel for manual operation in case of current failure. Available in 125 lb iron, 150 to 900 lb steel.

The action of an R-S Butterfly Valve is rapid and smooth. Four to six revolutions of the hand wheel or chain wheel fully open or close the valve vane. The compact, inherently narrow face-to-face dimensions, and the fact that there is no long stem or gate well, reduce clearance requirements to the minimum.

There is free passage for direct flow with no restrictions other than the streamlined vane. Sediment cannot collect since there are no right angle bends or reverse turns. Hence, the R-S Valve is ideal for the control and shut-off of dirty gas, dirty water, pulverized fuel or similar flowing solids.

The beveled vane wedges tight against the valve body for shut-off duty.

Write for catalog and detailed information about the use of R-S metals for resistance against heat, abrasion and corrosion.

R-S QUALITY PRODUCTS SINCE 1903

15 to 900 psi

VALVE DIVISION

R-S PRODUCTS CORPORATION

4536 Germantown Avenue Philadelphia, Penna.

R-S Streamlined BUTTERFLY VALVES

Fred Low and the other outstanding old timers.

Opposite number to the senior Coughlin in this class was youthful Lucille Edwards, George's private secretary and, incidentally, the transcriber of my preliminary notes. Living in the man's world of the steel mill, and the only girl at the Bellefonte power plant, Lucille is rapidly acquiring the vocabulary (the *technical* vocabulary, I mean) of the plant, so she can do a better job and get more fun out of it.

The only textbooks used are POWER's special sections on pumps and compressors, although many of the men study the Terrell Croft books on the side.

This course is a pioneer effort. Steam education at Ashland is still in the making, and future years will undoubtedly bring changes in detail. The fact remains that this year's course has paid big dividends in cleaner plants, better operation and maintenance, better morale.

George Coughlin has done his school-teaching job well in his own way. Other engineers are meeting this man-power problem by other types of practical training. Let's hear about some of these. Just drop a line to Editor Swain.

Rushville Diesel

(*Continued from page 86*)

trol; the balance of the control panels and the metalclad units provide for two 4160-v feeders supplying the substation, two station-service feeders, four generator circuits, and one bus-sectionalizing circuit. Control units stand near the generators; the circuit breakers are in a separate switchgear room.

One half of the sectionalized 4160-v bus connects two generator circuits, one substation feeder circuit and one station service circuit. The other half of the bus is identical. Sectionalization insures continuity of service and permits maintenance or additions to be made on a "cold" bus.

Each of two station service feeders connects to a 300-kva 4160/480-v station service transformer; one is a spare. The 480-v station power is distributed from a single metalclad distribution panel through a distribution feeder on the auxiliary-room wall, extending the entire length of the plant. Plant auxiliaries connect to this feeder at convenient points. Three 480/120-v dry transformers, each rated 10 kva, supply lighting.

SIVYER STEEL CASTINGS

"KNOW-HOW" MAKES WORTH LOOKING FOR

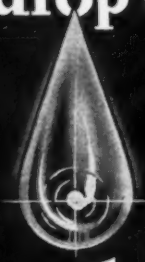
You don't make good steel castings just by ordering it done. It takes plenty of "Know-how" all along the line—from front office executive clear through to the end of the finishing room. Take the whole matter of melting, for instance: precise formulas, modern furnaces, ingenious controls are essential. But even these won't turn out good steel without a Melter who knows his stuff. From a fractured test bar he'll read facts which only long experience can tell: Whether the carbon content is right, what's happening to the silicon, whether, in short, the metal is "done" and "done" right. Sivyer knows it takes good men to make good castings. Sivyer customers have plenty of proof that Sivyer men turn out castings that are *worth looking for.*

SIVYER STEEL CASTING COMPANY

MILWAUKEE CHICAGO

ARMY E NAVY

Just a drop of water-



harmless···

or is it?

Although specially treated for use in your water consuming equipment, it may still contain a sufficient amount of water hardness to cause boiler scale, priming, foaming, pitting or corrosion or caustic embrittlement.

There's no question about feed water conditioned by nature's own method discovered in the new TECHNICAL Water Conditioning System . . . a perfect balance of water's mineral content with correct, natural *organic substances.*

WATER CONDITIONING SYSTEM

TECHNICAL is a proven, natural system of individual formulas to fit each and every water type. It provides a special balance of water properties that definitely overcome scale, foaming, pitting, corrosion, priming, caustic embrittlement characteristic of boilers and condenser covering systems.

For your own satisfaction, investigate the new TECHNICAL System . . . Nature's own conditioning method developed under actual industrial operating conditions. Without obligation the coupon below will bring you the facts.

WATER TREATMENT COMPANY OF AMERICA
1159 Hodgkiss Street · Pittsburgh, Pa.

☐ Please send the new Technical System bulletin.
☐ Haye a Water Treatment Company engineer call.

Name_____ Title_____

Company_____

Address_____

Distribution circuit breakers and step-up transformers stand in an outdoor substation near the building. The 4160-v feeder circuits run underground from plant to substation. Each of the two main step-up transformers is rated at 6000/8000 kva. They are combination fan- and self-cooled units.

Of the four outgoing 34,500-v overhead distribution circuits, three connect to the bus through oil circuit breakers. The fourth circuit connects to the bus through high-voltage fuses. Breakers operate from the control board inside the plant. A gang-operated disconnect switch permits sectionalizing the high-voltage bus, giving a high degree of flexibility throughout the entire switchgear. Each side of the bus connects to two outgoing circuits and the high-voltage side of one of the transformers. At present, only one main transformer finds normal use, the other serving as a spare; during operation the bus-sectionalizing switch remains closed.

Plans and specifications for the equipment were prepared by L H Henley, vice-president in charge of generation and distribution for the Southeastern Indiana Power Co. Burns & McDonnell Engineering Co prepared plans and specifications for modification of the building, designed the hot-air heating system, fuel-unloading facilities, plant wiring, and raw-water circulating system, acted as general consultants on the project and supervised factory and field tests of equipment. Soil surveys were made by Robert W Hunt & Co, of Chicago. George D Noiles is chief engineer of the plant, in charge of operation and maintenance.

Argument Corner

(*Continued from page* 122)

burned the T tile cannot be dislodged by puffs in the furnace, as can the roof tile. The upper tiles are turned upside down so that the flat surfaces of the two rows come together.

Aurora, Col. E J Duff

Protection Against Compressed-Air Explosions

It seems that the manufacturer supplying compressing equipment to BVN (see Power, January, 1943, pg 122) was somewhat remiss in not supplying his customer with full and complete information relative to protection against

"IT'S THE MOST RELIABLE METAL TUBING WE KNOW OF"

They all agree that it is . . .

And when production-conscious executives must have *absolute, 100% tightness* plus long life in flexible metal tubing, they usually specify American *Seamless* Flexible Metal Tubing. For past experience has shown them that this deluxe product will flex millions of times without failure.

American *Seamless* is all-metal, made from *seamless tubes.* It has neither joints, welds, laps, seams nor packing at which leaks might develop. It combines the flexibility of rubber hose, the dependability of metal, the strength of rigid pipe.

Another interesting feature—you can get American *Seamless* Tubing in practically any workable metal of your choice.

Throughout industry, American *Seamless* is almost a password. Countless war plants are using it to convey air, fuel, water, chemicals, cutting compounds, refrigerants, propane and butane, manufactured freon, ammonia, oxygen, hydrogen, nitrogen, acetylene and many other fluids. They use it too for controlling vibration and for connecting moving or misaligned parts.

Whatever your requirements you'll most likely find that we have a flexible metal tubing or hose that will help you do the job just a little bit better.

Why not investigate?

43200

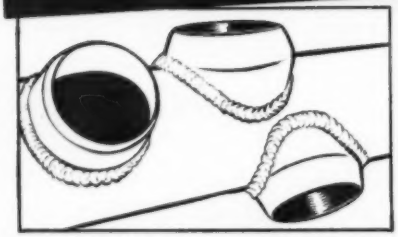
American Seamless—corrugated from seamless rigid tubing . . . pressure tight as the metal tube from which it is made.

ANACONDA

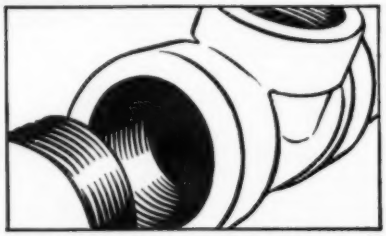
American Metal Hose

AMERICAN METAL HOSE BRANCH OF THE AMERICAN BRASS COMPANY • General Offices: Waterbury, Conn.
Subsidiary of Anaconda Copper Mining Company • *In Canada:* ANACONDA AMERICAN BRASS LTD., *New Toronto, Ontario*

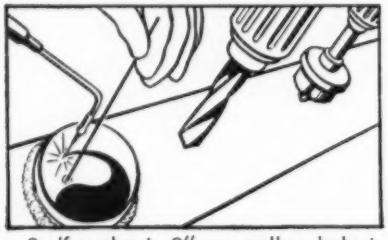
HOW W-T'S* SPEED UP PIPING INSTALLATIONS



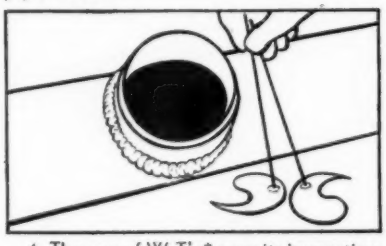
1. Branch pipe outlets can be made with W-T's* anywhere on the main pipe without the use of templets.



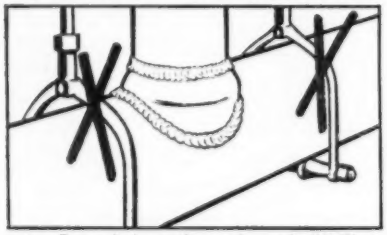
2. W-T's* eliminate all threading and fitting of main pipe in making branch pipe outlets.



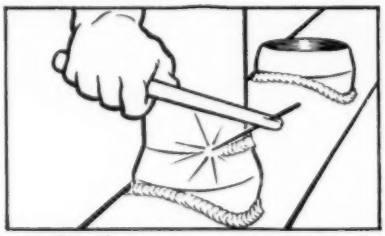
3. If outlet is 2" or smaller, hole is cut in the main pipe with drill or hole-saw before W-T's* are installed—on larger sizes, with torch after installation.



4. The use of W-T's* permits inspection of inside of joint, removal of scale and excess weld metal before branch is attached.



5. Funnel-shaped intake of W-T's* reduces vibrational stress at junction—eliminates need of extra braces and hangers.



6. Branch pipe is attached to outlet of fitting by welding—or, if outlet is threaded by screwing into outlet of fitting. W-T's* provide leakproof junction of full pipe strength.

W-T's* are suitable for all commonly used pressures and temperatures in every type of piping system. They can be installed before or after erection of the main line with ease and economy. Equally well adapted to pre-fabricated or "on-the-job" assemblies. Cost no more—in many cases less than ordinary fittings without their advantages. Stock fittings of drop forged steel, but to meet special conditions can be supplied in Monel, Everdur, Toncan Iron, wrought iron, etc.

Write for Bulletin WT-31 giving complete description of all advantages.

***WeldOlets-ThredOlets**

3 Types Meet Every Need

Beveled outlet of WELDOLETS permits branch pipe to be attached with plain butt weld.

Threaded outlet of THREDOLETS permits branch pipe to be screwed into outlet of fitting.

Outlet of SOCKET-END WELDOLET is bored to accept standard outside pipe diameters. Junction is completed with weld around top of fitting.

All 3 types available for all standard pipe sizes up to 24".

Forged Fittings Division

BONNEY FORGE & TOOL WORKS, ALLENTOWN, PA.

WELDOLETS •
TRADE MARKS - REG. U. S. PAT. OFF.
THREDOLETS
Welded Outlets for Every Piping System

explosions in compressed air systems.

Many experienced engineers believe that if pressure-relieving and controlling devices are kept in proper operating condition and the piping and vessels are free from defects or deterioration, there is little or no chance of an explosion occurring in a compressed air system. In contrast to this popular belief various authorities agree that the majority of so-called compressed air explosions are actually combustion explosions. These result from supplying excessive lubrication to the compressor cylinder with high discharge temperatures caused by poor compressor operating conditions such as leaking air valves or piston, scaled jackets, lack of cooling water, or hot inlet air.

Excessive lubrication, or the use of improper oil, usually results in the formation of gummy deposits in the air discharge passages and receiver. These deposits accumulate rapidly if the intake air is dirty causing restriction of the discharge passages and abnormal pressures and temperatures result which aid more rapid deposition.

The oily deposits have a marked affinity for the oxygen in the air and the rate of oxidation increases rapidly with an increase in temperature. In addition, the more rapid the oxidation, the more heat generated as a result of the chemical reaction between the deposit and the oxygen. If oxidation is sufficiently rapid the temperature for ignition is soon reached and particles of the deposit start to glow or burn. (Failure of the writer to turn on a compressor's jacket water once caused a fusible plug to melt out and glowing particles such as mentioned were blown twenty or more feet across the engine room). These glowing particles may ignite the oily vapor in the discharge pipe with a resulting explosion rupturing the pipe, or the flame may travel through the pipe into the receiver causing the vapor contained therein to explode.

There are some curious phenomena in connection with combustion explosions in that ruptures may take place at widely separated, or in relatively stronger, sections of piping when it naturally would be expected that failure would take place along one section or in the weaker part. It is reasoned that whereas the progress of the flame is comparatively slow at first, it accelerates rapidly and creates a pressure wave preceding the flame. The cumulative compression of the unburnt vapor preceding the flame causes a temperature sufficient to ignite the unburnt vapors and the resulting detonation ruptures a pipe section and relieves the pressure. In the meantime the flame has reached

AIR is LIFE to a miner...

but DEATH to unstable turbine oils!

IT'S the tiny bubbles of air in a hard-working turbine that cause oxidation. Ever present, they kill off an unstable oil in a hurry. But even the most adverse operating conditions make little difference to Shell Turbo Oil. Check the analyses at lower right . . . there's practically no difference in the characteristics of Shell Turbo Oil, even after 19,106 hours of wartime operation.

Here you have proof, under actual operating conditions, of the superior oxidation stability of Shell Turbo Oil.

Don't chance the possibility of oxidation or rust knocking out *your* turbines. Get the complete details on this and other outstanding performances of Shell Turbo Oil from the Shell man. Or, write Shell Oil Company, Inc., Dept. "D," 50 W. 50th St., New York, N. Y., or 100 Bush St., San Francisco, Cal.

SHELL TURBO OIL

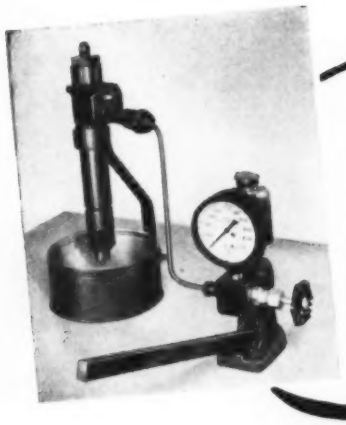
Currently, the U. S. Navy has first call on Shell's entire production of marine turbine oil

SHELL

Certified Proof of the Superior OXIDATION STABILITY of Shell Turbo Oil

SHELL TURBO OIL WHEN NEW	CHARACTERISTICS	SHELL TURBO OIL AFTER 19,106 HRS. OPERATION
156	*Viscosity @ 100° F.*	160
Clear	*Appearance*	Clear
.05	*Neutralization No.*	.05
.1	*Saponification No.*	.1
90	*Steam Emulsion No.*	90

Performance record of Shell Turbo Oil in a unit of the OWENS-ILLINOIS GLASS COMPANY, Streator, Ill.



ADECO NOZZLE TESTER
For Economical Maintenance

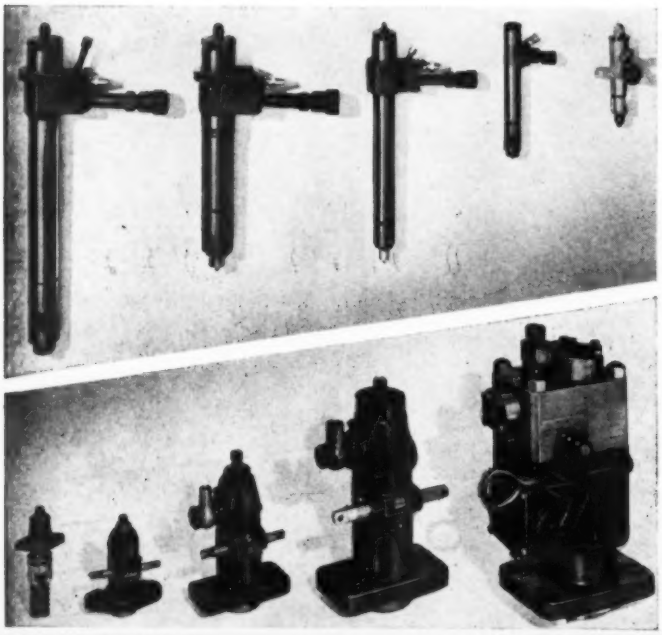
America's most widely used Nozzle Tester enables any mechanic to make quick, accurate tests on injector opening pressure, spray pattern, etc., and detect stuck needle valves and leakage around valve seats. Compact, portable, sturdy, precision-built. Pressures up to 10,000 p.s.i. Tests both large and small injectors. Avoids costly delays and possible damage to engine. Best for economical maintenance. Write for new illustrated bulletin.

ADECO "KNOW-HOW"

BRINGS YOU THE FINEST IN DIESEL FUEL INJECTION EQUIPMENT

Back of every Adeco product is a thorough knowledge of diesel requirements, gained through years of experience in serving the diesel industry. This understanding combined with Adeco's wide research and manufacturing facilities provides a most dependable source for the finest in diesel fuel injection pumps, nozzles and nozzle holders.

Write for complete Adeco Catalog



AIRCRAFT & DIESEL EQUIPMENT CORPORATION
4401 NORTH RAVENSWOOD AVENUE • CHICAGO, ILLINOIS

such velocity as to carry it beyond the local disturbance and a repetition of the foregoing results in a series of successive explosions causing ruptures at what may be widely separated sections of the pipe line.

Safety valves are practically useless as protection against the pressures attained so swiftly by a combustion explosion. The best insurance against such occurences is prevention of the conditions that produce the hazard.

Some devices for automatically controling compressor operation in the event of excessive discharge temperature are as follows:

(1) Cooling water regulating valve operated by surface mounted or immersion type thermostat on air discharge pipe. (2) Motor cut-out switch operated by thermostat on air discharge pipe and on the cooling water discharge pipe.

Even a plant having high priorities may experience difficulties obtaining any of the appliances mentioned and then it is up to the engineer to exercise his ingenuity and develop his inherent Rube Goldberg qualities. Pressurestats, aquastats, warm-air and limit controls taken from converted household oil-burners should with slight adaptation work ideally for air compressor control.

Any one desiring information relative to air compressor installations should obtain a copy of Chapter 18 of the U. S. Navy Manual of Engineering Instructions. This pamphlet is for sale by the Government Printing Office, Washington, for ten cents.

Melrose, Mass. E MACDERMOD

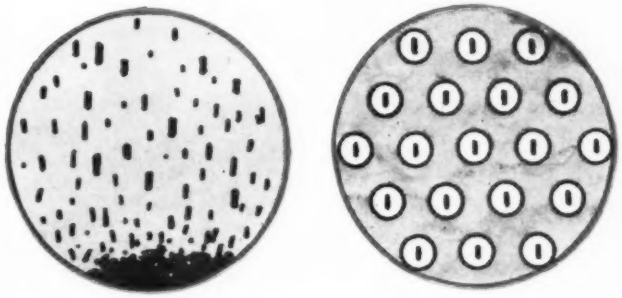
Contributes a Word of Caution

MAY I ADD A WORD of caution to the article, "Reducing Valve Keeps Pump Primed," by C S Clark, page 113, February POWER. If the pump is designed for a pressure equal to or greater than that in the city water main from which it is kept primed then there is no danger of wrecking the pump. Should this not be true then there is a real danger, because a faulty reducing valve could permit enough pressure to build up in the pump casing to burst it. I know of one pump casing failure caused by this condition.

Where there is danger of the priming line putting excessive pressure in the pump casing, then install a relief valve on the suction line, where it can discharge into the sump. Set this valve for a pressure well below that safe for the pump casing. Then on overpressure

How Detergency operates

Cross-sections illustrating oils in use



Non-Detergent

In this type of oil, carbon, oxidation products, dirt, etc., stick to each other and to engine parts . . . deposit in rings, on valves, clog filters, etc.

Detergent

In this type of oil, film *coats* carbon, dirt, etc., prevents particles sticking, holds them in suspension until trapped by filter or drained from engine.

New Detergency for low speed Diesels

Patented ingredient in new Nonpareil H. D. Diesel Oil brings new cleanness and stability . . . reduces wear.

THE GREAT benefits of detergency (see diagram), so highly valued for high-speed Diesels, are now made generally available for low-speed engines, through the introduction of new Nonpareil H.D. Diesel Oil. This addition to our Nonpareil line brings a step-up in engine cleanness that can be noticed quickly. It not only keeps engines cleaner, but in many cases will remove deposits left by other oils.

The detergency results from the use of an additive which is both a detergent and an oxidation inhibitor. This gives the oil a new high stability, lengthens oil life, and greatly aids in bringing clean engine operation. It also reduces wear.

The combination of all these qualities brings a practical end to troubles from (a) ring-sticking and piston scuffing, (b) excessive sludge deposits, and (c) excessive gum deposits.

Application of Detergent Type Oils. Many engines give clean operation with conventional oils, but where dirty operation cannot be corrected by mechanical adjustment, the use of detergent type Nonpareil H.D. Diesel Oil is indicated. A Standard Lubrication Engineer will gladly advise you whether a conventional or detergent type oil will give you the best possible results in your Diesels.

Cleanness Aided by Base Stocks and Refining. Nonpareil H.D. Diesel Oil comes in two grades: Medium and Heavy; and is offered in addition to our regular line of Nonpareil Diesel Oils. This line, over a period of many years, has established a fine record for engine cleanness and low engine wear . . . the results of careful refining plus the use of high quality stocks. Nonpareil H.D. Diesel Oils have the same high quality plus the addition of the detergent-oxidation inhibitor.

The new oils have been thoroughly tested and proved in the laboratory and field. In every case, the results have been outstanding. Why not let a Standard Lubrication Engineer help you select the grade suitable for your service? Make a test in some unit in which conditions are severe. Phone or write for the Engineer nearest you.

Ask about this New Oil!

Get the full facts about this great new oil, how its characteristics fit it for a wide variety of service conditions. Note its applications to various makes and models of Diesels, etc. Call any Standard Oil (Indiana) office, or write 910 South Michigan Ave., Chicago, Illinois. In Nebraska, address any Standard Oil Company of Nebraska office.

New
NONPAREIL H.D. DIESEL OIL

OIL IS AMMUNITION . . . USE IT WISELY

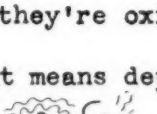
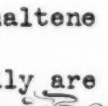
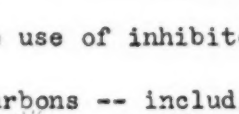
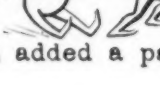
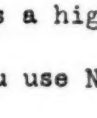
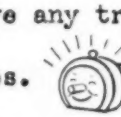
STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

•LUBRICATION ENGINEERING•••LUBRICATION ENGINEERING•••LUBRICATION ENGINEERING•••LUBRICATI

EXIT the asphaltene-forming hydrocarbon

(a message to turbine oil users)

Let a hydrogen atom meet a carbon atom down in the earth, and they unite. They have a "yen" for each other.

In petroleum, they are united in countless combinations to form highly complex hydrocarbons. Some of these are unstable. They have an affinity for oxygen. They "drink it in." Then they're oxidized and ready to go on a rampage. In turbine oil, that means deposits, acidity, sludge, poor demulsibility -- trouble!  Some of these little devils tend to form asphaltene substances, others to form acids. The asphaltene kind can all be removed by refining -- but generally are not. Those left act like poor apples in a barrel.  Conventional methods fail to get all of them out unless a high degree of refining is used. Without the use of inhibitors, such refining is undesirable because stable hydrocarbons -- including valuable natural inhibitors -- are also removed.  Nonpareil Turbine Oil is a highly refined oil to which has been added a patented inhibitor. When you use Nonpareil, you never will have any troubles from deposits, sludge, or poor demulsibility due to asphaltenes.  Acid-forming hydrocarbons  are another story. They can't all be removed by refining. How we render them harmless 

will be told in our advertisement next month. Meanwhile, if you want further information, send for a Standard Lubrication Engineer. Write or phone the nearest Standard Oil Company (Indiana) office, or 910 South Michigan Ave., Chicago, Ill. In Nebraska, write to Standard Oil Company of Nebraska at Omaha.

NONPAREIL TURBINE OIL

Oil Is Ammunition . . . Use It Wisely

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

★ LUBRICATION ENGINEERING

ONE of FOUR

Surface Condensers
Totaling 122,000 Square Feet

Typical of larger surface condensers designed and built by Lummus is this 36,000 square foot unit for a well-known public utility. Precision workmanship in the Lummus Company plant will facilitate easy and accurate assembly in the field.

All Lummus condensers are equipped with air ejectors designed and built by Lummus.

DESIGN FEATURES
LUMMUS SURFACE CONDENSERS

- Streamlined Tube Layout
- Internal Air Cooling Section
- Deaerating Hotwell

RESULTING IN —

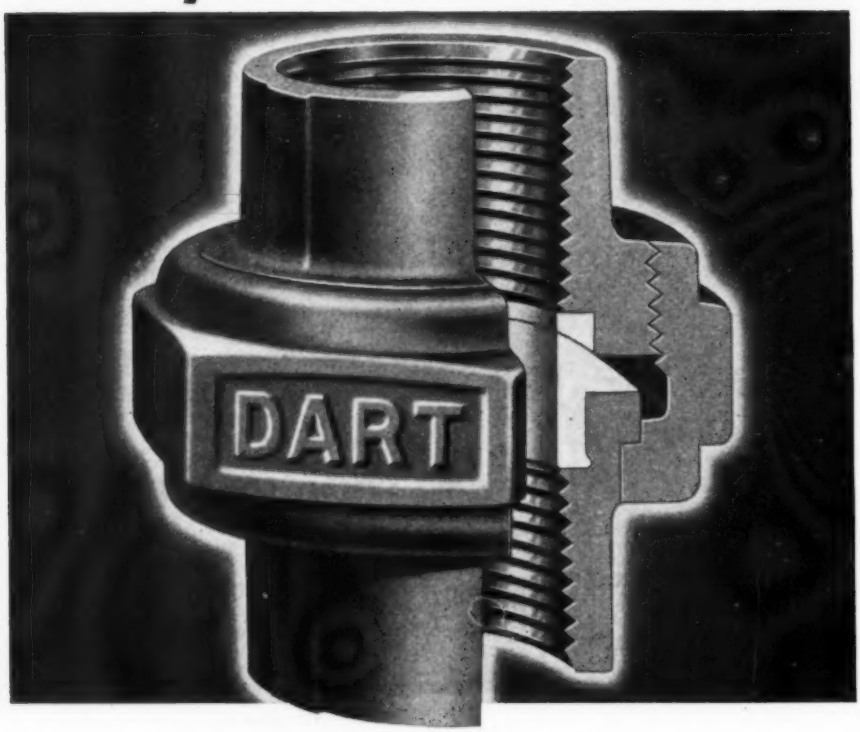
- Minimum Pressure Drop
- Minimum Condensate Depression
- Minimum Condensate Oxygen Content
- Minimum Air Ejector Steam Requirements

THE LUMMUS COMPANY · 420 LEXINGTON AVE., NEW YORK, N.Y.

LUMMUS

You Discover TREASURE

when you find Discarded Darts



...dig up your old Dart Unions and Put them Back to Work

You'll be in luck, if you can uncover some discarded Dart Unions around your plant. For a well used Dart is still a *useful* Dart . . . it can *still* give tight joint performance back on the job.

You see, Dart Unions are engineered and made to be used over and over again—and give complete satisfaction each time. Matched bronze seats, ground to true-ball surfaces is one reason why Dart Unions can do this. *Another* reason is that Dart bodies and nuts are made of high-test air refined malleable iron that resists pipe strains and rough handling.

So, "keep digging" . . . the rewards of finding used Dart Unions are worth the search. And if you need new Darts, your supplier will do his best to supply you and quickly as possible.

DART UNIONS

E. M. DART MFG. CO., PROVIDENCE, R. I.

the valve will function and protect the pump casing.

Hamilton, Ont. J A COULDEN

"Short Words Carry a Punch"

ESTEEMED SIR:

Upon perusal of your current publication, (POWER, March, 1943,) I was measurably intrigued by the incisive and authoritative discussion of the relative effectiveness of language characterized by the predominance of monosyllables. Mr. Ripley's dissertation "Short Words Carry a Punch" (pg 74) deserves respectful consideration and, unquestionably, is a fundamental contribution on the subject of the most advantageous procedure for the dissemination of ideas.

Noting your altruistic disposition to make this article available for individual distribution, subject naturally to certain essential and justifiable reservations, I am hastening compliance with the terms of your generous proposition.

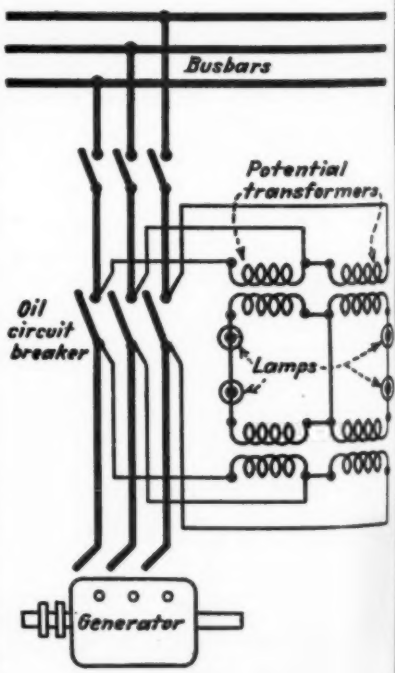
I hope you get this before the reprints are all gone. I would like to have it to 'flash' on a few around this place, when the need arises—which is plenty. Thank you.

B S BOWERMAN

Baltimore, Md.

Another Method of Checking Phase Rotation

THE INSTRUCTIONS given by James Wilson in May POWER for putting a new ac generator in service were complete.



"Tin Fish.."

Globe Steel Tubes Help to Make This Deadly Weapon of Modern War

Less than 20 ft. long, weighing approximately a ton, the deadly giant "tin fish" torpedo can blast a $60,000,000 battleship into jumbled scrap. . . . Within its cylindrical steel walls are 5,222 parts — 1225 different assemblies — for propulsion, navigation and destruction. . . . Some parts are machined to dimensions so close that their lubrication is accomplished with a medical hypodermic needle. . . . Seamless steel tubular parts for these most complicated and deadly devices of warfare are produced at Globe Steel Tubes. . . . Globe ability to produce steel tubes of exacting characteristics is effectively helping to perfect this most complicated device of destruction.

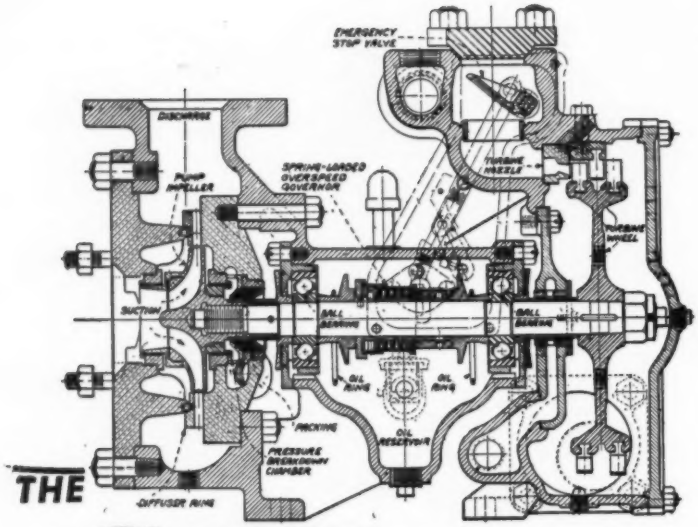
We salute the fighting courage of the torpedo plane squadrons who so skillfully drop "tin-fish" from the sky to hasten Allied Victory.

GLOBE TUBES

★ STAINLESS TUBES
★ BOILER TUBES
★ GLOBEIRON TUBING
★ GLOWELD TUBES
★ CONDENSER AND HEAT-EXCHANGER TUBES
★ MECHANICAL TUBING

GLOBE STEEL *Tubes*

GLOBE STEEL TUBES CO., *Milwaukee, Wisconsin, U.S.A.*



THE **COFFIN-Steam Turbine CENTRIFUGAL PUMP**

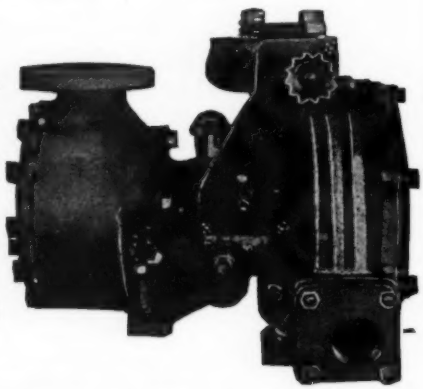
. . . a compact main boiler feed unit that saves space and weight.

General Specifications

PUMPING CONDITIONS	Type B	Type F	Type G
Gallons per minute	to 200	to 200	to 350
Discharge pressure	to 300	to 600	to 500
Temperature liquid (°F)	to 225	to 300	to 300
STEAM CONDITIONS			
Inlet pressure	to 250	to 500	to 500
Quality total temp.	to 450°	to 700°	to 700°
Exhaust pressure	to 10 lbs.	to 60 lbs.	to 60 lbs.
SIZE (Approximate)			
Height	21½"	21"	21"
Width	19"	20¼"	21"
Length	24½"	24½"	27"

WEIGHT (Approximate)
460 lbs. 485 lbs. 550 lbs.

PRESSURES TO—750 Lbs. per sq. in.
DELIVERIES TO—500 G.P.M.



Mail the Coupon

THE J. S. COFFIN, JR., COMPANY
ENGLEWOOD, NEW JERSEY

Please Send Descriptive Bulletin I-21

NAME

COMPANY

ADDRESS

P.W.

but I would like to add a supplementary method for determining phase rotation. The transformers may be connected as indicated without regard to polarity. With the generator leads disconnected and the disconnect switches closed, close the oil circuit breaker. Primaries of both transformer groups are now energized with power of the correct polarity for synchronizing the generator to the busbars. Therefore, the conditions shown by the lamps, dark or bright, must exist when the generator is connected to the switch before synchronism can be obtained.

Assume the lamps are dark. Open the oil circuit breaker and disconnect switches and temporarily connect the generator to its leads. Close the disconnect switches and bring the generator up to speed and voltage. All lamps will go dark or dim at the same time if the generator has correct phase rotation. If they do not then the generator has wrong phase rotation.

To correct this, interchange two of the leads at the generator terminals. Make another check for phase rotation. This time all lamps should go dark or bright together. When you have this condition, open the switches and permanently connect the generator leads. The generator can now be synchronized and the synchroscope checked by the phase-rotation lamps.

Brooklyn, N. Y.

C O VON DANNENBERG

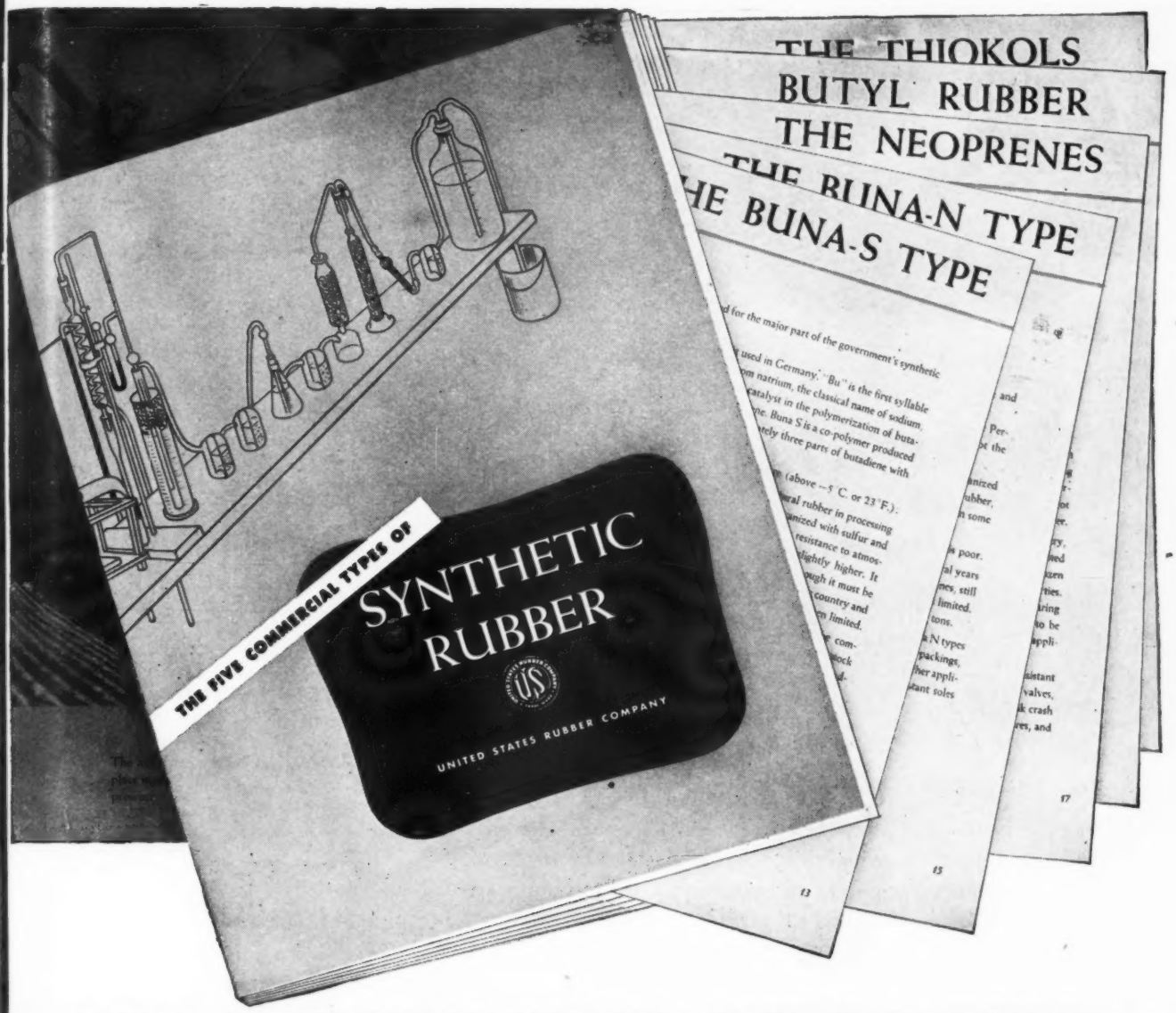
Turbine Lubrication

(*Continued from page* 71)

sludging can be anticipated and that the charge will require careful watching for further signs of actual breakdown. Failure of the oil as a lubricant may occur without further warning.

Every engineer in charge of turbines should maintain a record of neutralization number and viscosity. For the average turbine installation, samples should be checked about three times a year, more often if operating conditions are unusual.

It is possible to set down some approximate limits of increased viscosity and acidity that indicate breakdown points. The values, however, should be used with reservations because the quantity of oil in the system as well as the characteristics of the oil affect the limits. For example, a large oil charge of, say, 1000 gal may rise above a set limit without any sign of breakdown while a smaller charge may begin to



WHAT IS SYNTHETIC RUBBER? HOW IS IT MADE? WHERE IS IT USED? HOW DOES IT COMPARE WITH NATURAL RUBBER? *You'll find the answers in this new book*

As the supply of natural rubber diminishes, undoubtedly more and more mechanical goods will be made of synthetic rubber... hose, belts, packings, molded goods, tank linings, and other rubber products used by industry.

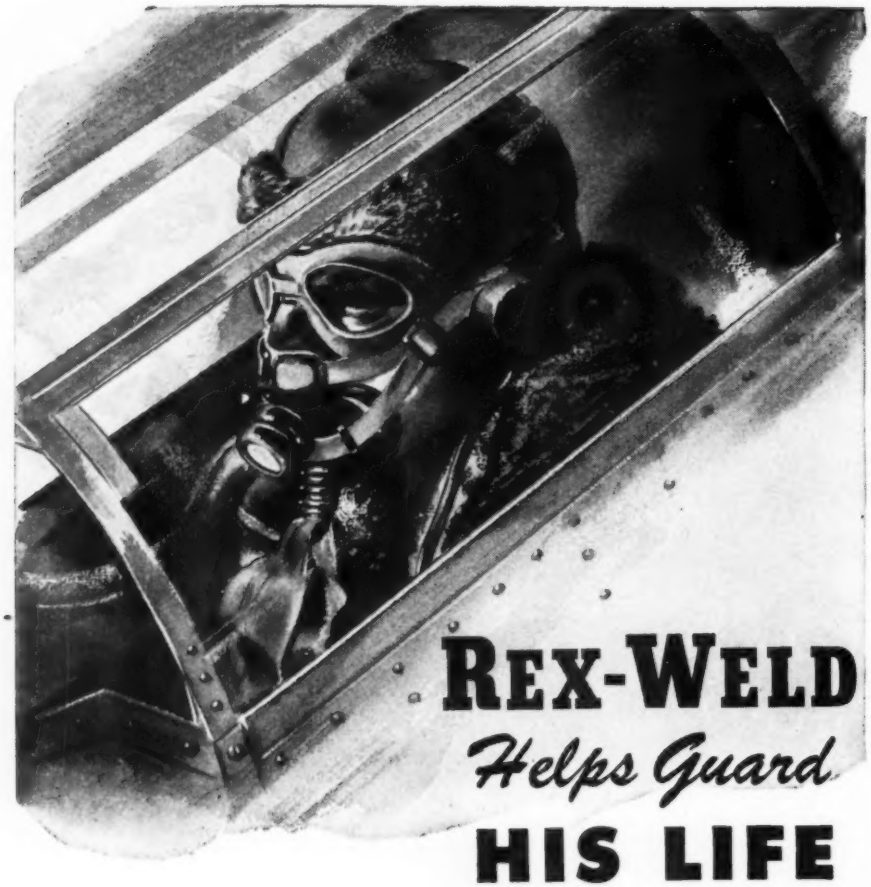
Having worked in the field of synthetic rubber for more than twenty years, we know what each of the five types will do; what chemicals such as sulfur, carbon-black, or ultra-accelerators must be added, and how to compound them. We work with all five types; use the type available that is best suited for the purpose.

You can get an over-all picture of the properties and characteristics of synthetic rubber in the new book recently published by United States Rubber Company. A request for "The Five Commercial Types of Synthetic Rubber" made on your company letterhead will be filled promptly. Address your letter to Dept. 17.

UNITED STATES RUBBER COMPANY

Listen to the Philharmonic Symphony program over the CBS network, Sunday afternoon 3:00 to 4:30 E. W. T. Carl Van Doren and a guest star present an interlude of historical significance.

1230 SIXTH AVENUE · ROCKEFELLER CENTER · NEW YORK
IN CANADA: DOMINION RUBBER COMPANY, LTD.



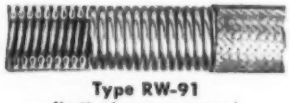
REX-WELD
Helps Guard
HIS LIFE

REX-WELD Flexible Metal Hose has met the critical test that demands only the best materials for our combat planes. More and more bombers, fighters and interceptor-pursuit ships are being Rex-Weld equipped.

REX-WELD's war service is not confined to the planes themselves. In the steel mills and munition factories, on the production and assembly lines, everywhere that war-worthy flexible connections are needed, REX-WELD is rendering vital service.

There are specific reasons for this. REX-WELD is a specially constructed flexible metal tubing. It is fabricated from strip metal by a precision autogenous welding process that produces uniform, stronger wall structure plus extreme flexibility. REX-WELD stands up under high pressures, high and low temperatures, extreme contraction and expansion. It is seep-proof to gas, water, oil, air and searching fluids.

Type RW-81
(annular corrugations)



Type RW-91
(helical corrugations)

Available in continuous lengths to 50 ft. Both Steel and Bronze. 3/16" I. D. to 4" I. D. inc. Pressures to 14,500 p.s.i. Temperatures to 1000° F.

Write for Engineering Recommendations

CHICAGO METAL HOSE CORPORATION

General Offices: MAYWOOD, ILLINOIS
Factories: Maywood and Elgin, Illinois

show signs of execessive sludging at lower values.

In general, an oil charge of viscosity 150 SSU at 100 F with a neutralization number of 0.05 when new should not be allowed to increase beyond 160 SSU and 0.3 to 0.5 neutralization number. A 300 SSU oil might be limited to 325 SSU and 0.3 to 0.8 neutralization number. Heavier oils of 400 SSU should not pass 440 SSU and 1.0 neutralization number. For limiting values on specific oils, the oil refiner should be consulted.

EDITORS's NOTE: Further details on inhibitors, oil purification, foaming and cleaning oil systems by Mr. Forbes will appear in August Power

Refrigeration Facts

(*Continued from page 68*)

level in sight during operation. Before stopping compressor, close the valve. An extension pipe inside connects to the valve and extends to within about an inch of the receiver bottom.

Drain valve on receiver bottom. It also serves as a purge valve. Most of the oil that is pumped past the compressor finds its way through the condenser to the receiver. Purge this oil regularly. If allowed to collect, it is carried over by the liquid to the cooling coils, collects there and greatly reduces their capacity.

Oil separators installed between compressor and condenser. They must be purged of oil regularly; use drain valve on bottom for the purpose. These separators remove a considerable portion of the oil pumped past the compressor. Purge oil by the method outlined for purging air.

Coolers

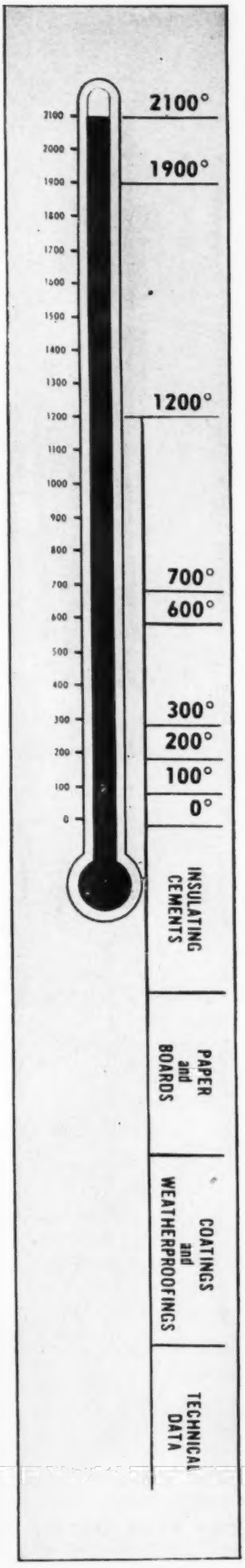
Several types of coolers are in general use: Baudelot coil, trunk and plate coolers:

Baudelot coil cooler. One of the older Baudelot coolers of the direct-expansion type consists of several sets of coils. Liquid ammonia flows through a header at the bottom with an expansion valve for each coil. Gas flows off at the top through a suction header. Pressure carried on this type of coil is considerably lower than that on the flooded coils because the coils are continuous, and while pressure is high at point of liquid admission, it gradually falls through the length of the coils. Raising the pressure by admitting more liquid introduces the danger of liquid being

ASK FOR IT →

RU-BER-OID
INSULATION GUIDE
HEAT OR COLD INSULATION GUIDE
RU-BER-OID
RECOMMENDED INSULATION PRODUCTS TO CUSTOM BUILT JOBS FROM SUBZERO TO TEMPERATURES OF 2100° F.

Index to guide, actual size. Facts at your finger tip.



Valuable at all times . . .

ESSENTIAL IN WARTIME!

adequate answers to your insulation problems

. . . SHORTAGES! PRIORITIES! AVAILABILITIES!

Side-indexed to give you, in seconds, the Ruberoid Thermal Insulation best suited to *your* needs! This book is meaty, factual—complete with informative charts and tables. A few minutes' reading familiarizes you with the full line of Ruberoid Insulations, the temperatures and conditions which they serve. Between its covers, too, is real help—quick—in solving many war-created problems affecting insulation.

FREE to power engineers and executives upon request. Just say: "Send me your Ruberoid Insulation Guide." Address The RUBEROID Co., Executive Offices, 500 Fifth Ave., New York, N.Y. Dept. P7.

The Ruberoid Insulation System covers every vital phase—the right *Materials* for the job; the right *Men* to do it; and the right *Methods*. You get all three with Ruberoid Thermal Insulation.

MATERIALS, MEN, METHODS—all 3 with

RU-BER-OID

THERMAL INSULATIONS

buell

DUST RECOVERY SYSTEMS

Recognized throughout industry for their outstanding qualities and performance

★★ High Efficiency mechanical flue dust collection to meet the specific requirements of any job

★★ Ready Adaptability to any existing duct work

★★ Low Initial Cost

★★ Low Maintenance and Operating Cost

★★ Power Consumption as low as 1 H.P. per 20,000 pounds of gas per hour.

BUELL ENGINEERING COMPANY, Inc.

10 CEDAR STREET, NEW YORK

WRITE FOR BULLETIN G-842

Buy War Bonds and Make the Axis Bite the Dust

carried over to the compressor. Some plants have accumulators or surge drums between cooling coils and compressor, which helps somewhat to prevent carryover. Adjust expansion valves so that each coil does its share of work. Carry the highest suction pressure that produces the cooling effect needed.

Distributing troughs or spray pipes on top of Baudelot coils form an important part of the cooling system. Check the troughs frequently to see that they are level and that liquid to be cooled distributes evenly over the coils.

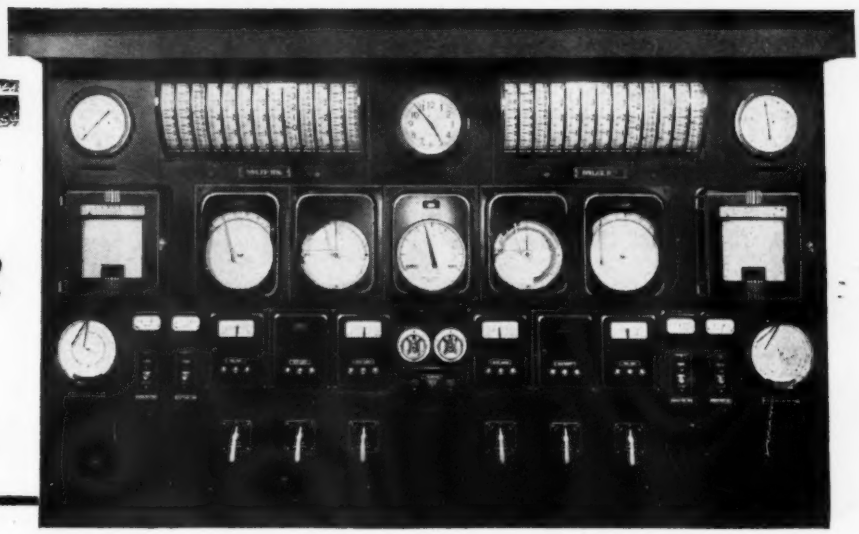
There are many arguments, pro and con, as to the advisability of allowing ice to accumulate on coils. With excess coil capacity and large Baudelot tank capacity, icing does no harm. It has the one advantage of helping to keep tank liquid cold during shutdowns. However, remember that melting ice temperature is 32 F, which is the surface temperature over which Baudelot water circulates. With no ice on coils and a good liquid flow, coil temperature can be lowered considerably below this point, with consequent faster cooling.

V-type coil trunk cooler. One of the reasons for its high efficiency is the rapid forced circulation of water over the coils, which retards ice formation. But if too low a suction pressure is carried, the coolers will ice up; when they do, their capacity is tremendously decreased because of the close pipe arrangement.

This cooler is efficient and fast, but its construction and coil arrangement prevent thorough cleaning and painting once coils start to rust. The unit operates on the flooded system, and the coils are kept full of ammonia by a float valve or regulator connected to a vertical surge drum. The float case carries a bypass connection and hand expansion valve for emergency use. Rapid circulation of water past the coils and absence of ice coating make this cooler very sensitive to load changes. For this reason, we install a suction pressure regulator in the suction line. This maintains a steady pressure on the coils regardless of suction pressure at the compressor.

Plate cooler. This is a later development of the Baudelot coil, made of stainless-steel sheets, corrugated and welded to headers at each end. It operates on the flooded system and is designed to cool the liquid passing over the plates with a minimum amount of recirculation. If plates ice up, the additional weight strains connections and causes leaks.

Ammonia float regulator. It serves for either high- or low-pressure service. The high-pressure float is similar to



A REAL *CONTROL CENTER* FOR YOUR POWER PLANT

ALWAYS on the alert to detect signs of combustion trouble and quick to correct it Hays Automatic Combustion Control stands guard over your power plant . . . a real CONTROL CENTER.

It performs *automatically* what a crew of operators would do manually to maintain an even steam pressure under fluctuating demand.

It never gets air-raid jitters, never minds long hours, never gets tired, nor forgets. It's on the job 24 hours a day, seven days a week.

It relieves man power and stretches steam capacity by keeping air and fuel rates in accurately measured proportion to each other and in direct relation to the plant load.

It permits operation of your boilers closer to their maximum capacity with a greater degree of safety and economy than possible under manual operation. It stretches steam capacity.

Hays Centralized Automatic Combustion Control is a real CONTROL CENTER for your power plant—vital to all-out war production. Send for latest literature . . . it may be helpful.

THE MODERN SYSTEM *It's Electrical*

HAYS *Automatic* COMBUSTION CONTROL

THE HAYS CORPORATION • MICHIGAN CITY, IND.

SEALING SPECIALISTS for INDUSTRY

For more than half a century, Babbitt specialties have been internationally known throughout industry. In the field of scientific sealants, one of the foremost names has been Namco, Inc. These two well-known names are now combined.

BABBITT *Plastic* SEALANTS

Joint and Gasket Compounds

were developed through the research facilities and field experience of the Babbitt and Namco organizations. These sealants have been scientifically formulated to hold steam, water, oils, and other liquids, chemicals, solvents, and gases, yet retain permanently workable joints.

Throughout industry there are countless applications for Babbitt Plastic Sealants in plant maintenance, on operating equipment and for "on product" use. Since Babbitt Sealants never "cement" a joint, speed and efficiency in pipe line maintenance are increased, and valuable savings in manpower and material are made possible.

If you have a sealing problem of any kind, the chances are that there is a Babbitt Plastic Sealant to solve it.

THE STORY OF SEALANTS: *This new, 12-page book describes the development of Babbitt Plastic Sealants, their uses and applications. Write us on your letterhead for a copy.*

Babbitt
All Over the WORLD

BABBITT INDUSTRIAL SPECIALTIES CO.

International Building
Suite 3155, 45 Rockefeller Plaza, New York

the usual float-operated steam trap. The regulator permits passage of liquid but not of gaseous ammonia, and acts as a seal on the condenser to eliminate need of a receiver. The low-pressure float maintains liquid level in the flooded cooler.

All floats should be protected by strainers on the inlet side, which should be cleaned regularly. Floats have a tendency to stick, when either wide open or shut. If a high-pressure float sticks when shut, suction pressure drops rapidly; if it sticks when open, head pressure drops and suction pressure rises. The same is true of low-pressure floats, except that they are supplied by a receiver and the effect is not produced quite so rapidly. However, regardless of the float's job, it cannot function perfectly under widely varying load conditions.

Drag Scrapers

(*Continued from page* 75)

Nothing in the drag-scraper principle nor in the accepted theories regarding causes and prevention of spontaneous combustion places a limit on pile depth. In a properly layered-in pile the sources of any firing are within some 15 ft. of the surface; in higher piles an increasing percentage of the pile is therefore immune.

Coal is a dirty commodity and its storage is a dirty business, at least on the surface. Coal handling, like show business, must go on—and the weather is sometimes dirtier than the coal. However design and layout of a storage system can do much to make the job cleaner and easier, and to reduce the size of the crew.

Drag-scraper storage permits chuting coal from conveyor systems to storage with a minimum of dust. Removing personnel from the area and from its hazards of dust and bad weather, means that the show can go on, and in comfort, as far as spreading or reclaiming coal is concerned.

A comfortable cab for the operator, with convenient and easily manipulated controls, makes it possible to replace "floating" labor with one permanent, satisfied operator per shift. Labor cost of drag-scraper operation, per ton, varies widely with hourly capacity and actual plant turnover. At worst, the figure is reasonable and continuously predictable.

Turning now to over-all costs, let's look briefly at the results of the only

NICKEL AIDS THE AUTOMOTIVE INDUSTRY

to KEEP 'EM ROLLING!

Using ingenuity and "know-how" born of long experience, automotive engineers designed the phenomenally successful transport equipment that now speeds the United Nations on the road to Victory.

Built to take punishment far above peacetime requirements, these specialized military vehicles are being produced in quantity by the mass-production methods that have amazed the world. From North Africa to the South Pacific, these trucks, jeeps, tanks and half-tracks have repeatedly met wartime demands for stepped-up performance.

This kind of engineering-thinking pioneered the application of Nickel alloyed materials. Now, when uninterrupted operation is so vitally important, the continued and widespread use of Nickel is clear evidence of its many advantages.

In steering knuckles or differentials, in forged gears or cast blocks, a little Nickel goes a long way to provide essential dependability. It improves strength/weight ratios, increases wear and corrosion resistance, imparts toughness, and assures uniform properties of the other metals with which it is combined.

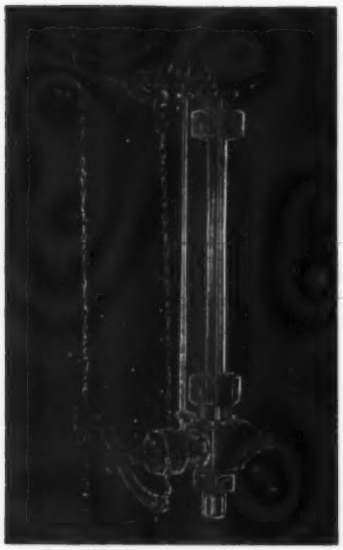
Today, maintenance crews on far-off battle fronts are learning what metallurgists and engineers here long have known . . . that, properly used, Nickel aids to "keep 'em rolling."

For years the technical staffs of International Nickel have been privileged to cooperate with automotive engineers and production men . . . men whose work is now so necessary to the Nation. Counsel, and printed data about the selection, fabrication and heat treatment of ferrous and non-ferrous metals is available upon request.

★ *Nickel* ★

For lists of current publications, please address Technical Library Service

THE INTERNATIONAL NICKEL COMPANY, INC., *67 Wall St., New York, N.Y.*



"PBH" Vertical Gauge

"PBH" Tiltview Gauge (Patented)

Quick as a YANK!—

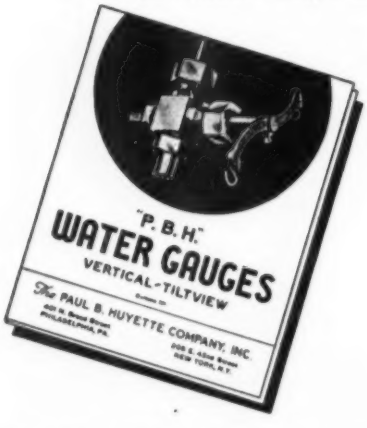
Accidents sometimes happen even to the superfine quality glass used in

HUYETTE WATER GAUGES

But a broken glass is no cause for scalds or burns, because Huyette Gauges are closed with one yank of the valve chain—a quarter turn does it.

Check These Exclusive Features:

All valves are polished, heavy, well proportioned and made of Bronze mixture according to A.S.M.E. Code. Maximum working pressure stamped on each valve. Glass and stem nuts are large to accommodate ample size packing to insure steam proof-leak tight service. All extra heavy valves have monel metal loose disc valve stem tips and 3/8" union drain or blow off connection on lower valve. Stem packing is the gland type ample in size. All gauges can be equipped with automatic ball check.



◆

For the complete PBH line of Power Plant Equipment, write today for catalog A34R.

THE PAUL B. HUYETTE CO., INC.

Established 1896

405 N. BROAD ST., PHILADELPHIA, PA.

widespread survey of drag-scraper costs that has been made. Back in the early twenties, the National Coal Handling Committee asked me to prepare a preliminary report on cost of storing and reclaiming coal by the drag-scraper method. As a basis for the report, we sent questionnaires to all known users, in the U. S., of drag-scraper storage plants—of all standards and makes. These questionnaires were designed to develop *operating*, *maintenance* and *capital* costs on a per ton basis.

The least favorable operating cost included an item of twelve men for unloading frozen cars. The most favorable involved no ground crew and only one operator per shift for an annual turnover of about 60,000 tons. Lumping power, maintenance and labor costs, showed about 3 to 6.5 cents per ton handled. Wide variations in accounting methods and, more particularly, differences in the load factor at which coal-handling equipment operates made it impossible to reach any conclusion on capital cost.

Plants Furnish Data

Since I made this check, many individual plants have furnished figures. Increases in many elements of cost, such as labor, offset to a large degree savings effected by greater efficiency in more advanced designs and larger installations. Thus, cost per ton handled still falls pretty well within the brackets shown in the original survey.

One important factor is the readily predictable and straight-line characteristic of the cost curve for a stated capacity and turnover in drag-scraper plants. This arises from the fact that unit cost of power (see chart), and of maintenance vary almost directly with the average distance coal is moved into and out of storage. The two costs are nearly independent of the plant's age.

This significant and important characteristic results from these three factors: Mechanical equipment is simple and can be designed for long life; much of the original cost is in structures as against machinery; and about 65% of maintenance cost represents the expendable items of wire rope and sheaves. They are as serviceable at the end of 20 years as at the beginning because they have been replaced. One plant, using 3400 ft of 1-in. rope, has predicted the replacement date within 30 days for years, and cost-per-ton for cable has averaged 0.6 cents per ton *consumed*—half that per ton handled.

Considerations that recommend power drag scrapers for storing and reclaiming coal are: (1) flexibility as to shape of ground space, future ex-

They provide protection against vibration and torsion

SERVICE: Recommended for service on steam, oil, water, brine, Freon, compressed air, acid, carbon-dioxide and gas lines for steam working pressures from 125 to 300 lbs.

TYPES: Faircoseal Bronze Valves are made in gate valves with solid wedge, non-rising stem . . . globe valves with renewable composition disc; regrinding bronze disc and integral seat; plug-type disc and renewable nickel-alloy seat and disc; regrinding nickel-alloy disc and renewable seat . . . swing check and lift-type check with bronze disc. Available in sizes from ¼" to 2".

FEATURES: Faircoseal Bronze Valves contain preinserted rings of Sil-Fos silver brazing alloy in the port openings, with which valve and pipe can be easily brazed together by applying an oxy-acetylene flame. When connected to brass, copper or copper-nickel pipe or tubing, a "Silbraz" or silver-brazed joint is formed—not a soldered joint.

It is designed to withstand as much tension, compression, torsion, vibration and corrosion as the pipe with which it is connected. These joints have high tensile strength and will not pull apart at any temperature to which the valve or pipe can be safely subjected; yet they can be taken apart, if desired, by a reapplication of oxy-acetylene heat. No wicking, solder or pipe dope is needed to make a tight seal.

Write for Catalog No. 42.

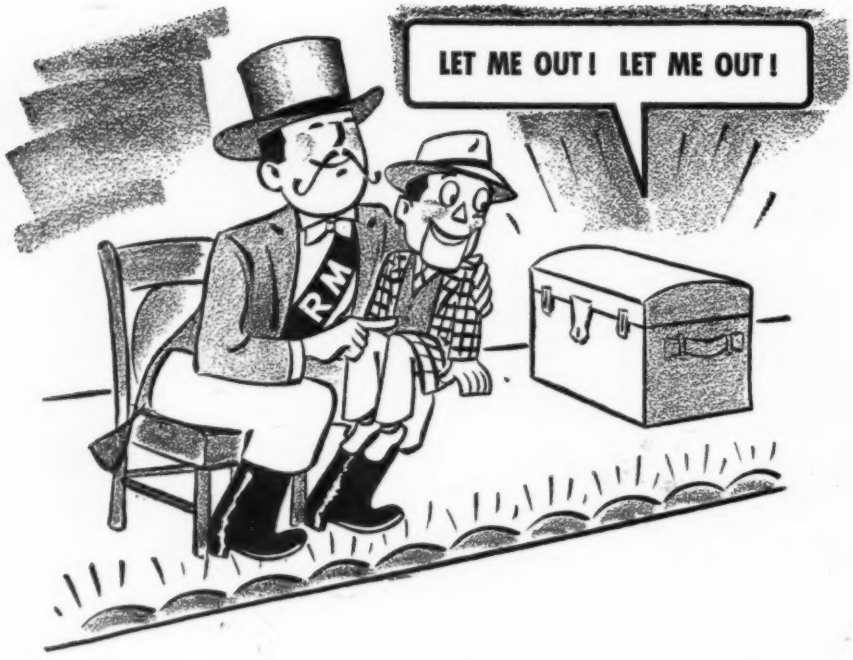
OTHER FAIRBANKS VALVES

Bronze Globe, Gate, Angle Cross and Check Valves
Iron Globe, Gate, Angle, Cross and Check Valves
Faircoseal Bronze Valves
U-Bolt Gate Valves
Asbestos Packed Cocks
Bronze Radiator Valves
Sphero Ball Valves

THE FAIRBANKS COMPANY

393 LAFAYETTE ST., NEW YORK, N. Y.
BOSTON, MASS. PITTSBURGH, PA.

Distributors in Principal Cities



R/M PACKINGS are hard-boiled jailers!

Steam, air, fuel, and oil can cry "Let me out! Let me out!" till they're blue in the face, but R/M packings won't budge an inch. Or even a quarter-of-an-inch. Their job is to hold fluids, air, steam, and gases in the line . . . to prevent leaks and, therefore, losses. Industry at war can't *afford* leaks and losses.

R/M engineers are never satisfied. What is good enough today must be improved tomorrow, if at all possible. They expend midnight oil and toil to see that R/M packings are the best that men, materials, and methods can put together.

Awarded to R/M North Charleston Plant

Do you have a copy of the R/M catalog? It's keyed for applications, illustrated, and indexed as to materials and types. Ask your jobber.

INDUSTRIAL SALES DIVISION
RAYBESTOS-MANHATTAN, INC.
MANHEIM, PA.
BRIDGEPORT, CONN. NORTH CHARLESTON, S. C. PASSAIC, N. J.
Makers of Packings for Every Industrial Use

tension, depth of storage and handling capacity, (2) safety of personnel and of fuel stored, (3) economy of fixed and operating costs, and (4) minimum use of strategic materials.

These advantages, particularly conservation of critical materials and original costs consistent with possible short life, when coupled with minimum use of skilled and unskilled labor and security against long shutdowns, have resulted in wide use of drag scrapers. At war plants and for emergency storage at many kinds of plants, the simple back post units have been favored for short life plants but emphasis is placed upon the use of fully mobile and centrally controlled units for larger and for permanent installations.

Maintenance Tips

(*Continued from page* 78)

power is switched off or on. Filament or heater burnouts may be detected quickly by inspecting glass tubes or by feeling metal ones for heating. *Remove power before touching metal thyratrons and ignitrons.* Sometimes an overloaded transformer or reactor fails because of the expansion cycle as power is removed and applied. Here, however, failure is usually preceded by excessive heating, odor of hot material, melting of sealing compound, or smoking or charring of insulating paper.

When Equipment Fails During Operation After a satisfactory period, if operation suddenly becomes unsatisfactory or ceases altogether, noting the exact symptoms of failure often isolates the trouble to a specific cause. Power failure or a blown fuse results in an instantaneous operating change. Before total failure, an overloaded transformer, resistor or wire is usually indicated by heat and smoke. Before placing the equipment in service again, correct the cause of overload—whether short circuit, load-coil burnout or motor-bearing failure.

Failure in a tube cathode circuit permits the cathode to cool gradually over a period of seconds or even minutes. Therefore, as in the case of power failure, loss of operation may be gradual rather than sudden. Small rectifier- and battery-operated tubes, however, cool quickly.

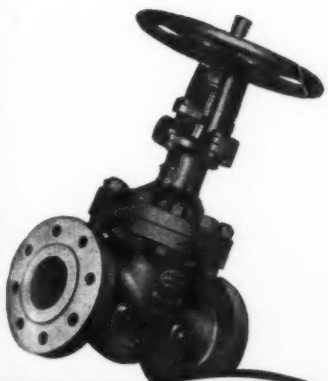
If none of the above causes for failure are evident, go carefully through the circuit operation and analyze each step. Consult an instruction book for the particular panel, or at least an ele-

Darling Valve & Manufacturing Co. is more than 40 years old in experience but is modern in facilities. It can serve you best by solving your problems and recommending valves that last longer.

WANTED! THE TOUGHEST VALVE JOB YOU'VE GOT

● In every plant there is at least one "impossible" valve problem — that's the one we want! No matter what it involves—corrosive or erosive materials — high or low pressures or temperatures — mechanical operation to accurate timing — special alloys — unusual installations—severe operating conditions — where other valves have failed, have cost too much, have caused you trouble — *that's* the place Darling Gate Valve design can positively prove its value.

At your service are the engineers of the Darling Valve & Manufacturing Co. Working with actual field problems for over 40 years, this staff has met and solved almost every possible type of valve problem—perhaps the very one you are faced with now. Their service is yours without cost or obligation. Write or call the Darling Valve & Manufacturing Co., Williamsport, Pa.



Darling offers you a quality line of longer-lasting Gate Valves. They come in Fully Revolving Parallel Seat Double Disc, also in Taper Seat — Slotted and Solid Wedge types. In service pressures up to 3000 pounds, you can get Darling Gate Valves in Cast Iron, Bronze, Forged Steel, Cast Steel, and Corrosion Resistant Alloys. Darling also manufactures Compression Type Fire Hydrants, Check Valves, Motor and Cylinder Operated Valves, and many accessories.

TRADE DARLING MARK

VALVE & MANUFACTURING CO.
WILLIAMSPORT, PA.

NOW—and After Victory

● Saving fuel, giving greater boiler capacity, meeting the requirements of exacting control, supplying positive drainage of processing units and heating equipment, enabling production units to meet their potential efficiency, making man power more effective—these are advantages being supplied now by Stickle Equipment—advantages this equipment will continue to make available after victory—advantages that are the result of 35 years specialization in developing and building better steam specialties.

For complete information and data request these bulletins:

BULLETIN NO. 50 explains how Stickle Differential Drainage and Boiler Return System returns condensate to boilers at a temperature only 15 to 20 degrees lower than temperature of steam at operating pressure.

BULLETIN NO. 117 describes various sizes and types of Stickle Open Coil Feed Water Heater.

BULLETIN NO. 200 supplies data and information on Stickles Triplex Oil and Steam Separators.

BULLETIN NO. 115—Steam Traps for smaller processing units, unit heaters, etc., operating at medium and high pressures.

BULLETIN NO. 315—Steam Traps for larger equipment operating at medium and high pressures. BULLETIN NO. 515—Steam Traps for high pressure equipment producing extremely large volumes of condensate.

BULLETIN NO. 415—Steam Traps, Small to large, for equipment operating at low and medium pressures and for vacuum service.

BULLETINS NOS. 235 and 435 describing Regulating and Reducing Valves, small to large sizes, Single and Double Seated construction, Lever Operated, Lever and Weight Loaded Diaphragm Operated, Spring Loaded Diaphragm Operated and Pilot Operated.

STICKLE

STEAM SPECIALTIES COMPANY

2265 Valley Avenue • Indianapolis, Indiana

SPECIALIZING FOR 35 YEARS IN REDUCING THE COST OF STEAM

mentary diagram of the circuit. If the circuit is at all extensive, you can usually divide it into two parts—for example, the control and power circuits of a welding control. Then it may be possible to use a meter, electronic voltmeter, cathode-ray oscilloscope or some other means to determine whether the control section is operating correctly as the input is varied over the normal range. Likewise, a simulated control signal may be applied to the power circuit to test that half.

Similarly, you can further subdivide each circuit part until you find the faulty circuit or part. With a clear knowledge of each part, checking is rapid. It is a good idea to check panels while they are operating correctly and to record voltages found and cathode-ray traces seen between specific points. In this way, any differences in a defective panel are evident immediately, and trouble-shooting takes much less time.

If trouble is recurrent in certain circuit parts, notify the manufacturer. Often he or his design engineers may offer a more permanent solution. Sometimes, slight changes provide more desirable characteristics. In every case, give complete information from the panel nameplate, as well as a description of the part and the trouble found so that the manufacturer may render quick and effective assistance.

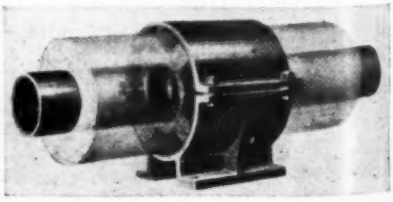
New Equipment

(*Continued from page* 126)

entirely within the case of a Fulscope single duty recorder controller. It can be supplied already installed in new instruments, or it may be added to equipment already in the field. *Taylor Instrument Companies, Rochester, N. Y.*

Pipe Alignment Guide

ADSCO PIPE ALIGNMENT GUIDE, Model G, is an improved product which has been redesigned to save critical metal and machining operations. It is used on steam, hot water, fuel oil or other pipelines adjacent to expansion joints to insure true alignment of pipes in service. It consists of a semi-steel spider and guiding cylinder allowing for a



Again...

THERE GO YOUR VALVES

Pig Boats

d Tin

With a crew o
rine in Pacif
to sink twenty or
end of this war. A
men and with many
er, can count itself ext
well. The 120 to 150 men who
destroyer will be pleased if they are
a cruiser's bag. As for the 1200 men on a
ship, their chances of doing spectacular damage
to enemy craft are governed by luck. Not more
than once in one war do they expect to use their
killing capacity to the limit. By the nature of his
ship and machine, a submariner thus rates him-
self as the most efficient killer in the science of
naval warfare.

By its very limitations, the submarine offers its crew opportunities to do damage to the enemy which are not given sailors on other types of vessels. Ninety per cent of the time during war our pig boats are looking for the enemy. Cruisers and destroyers, on the other hand, must often pass up the privilege of fighting in order to carry out some broad strategic objective; thus convoying, reconnaissance and scouting become a kind of boresome duty the submariner seldom knows.

Like the crews of Flying Fortresses and Liberators, pig boat men are trained hair-fine for team action. To an extent impossible to sailors on cruisers and destroyers, the security and efficiency of each one is involved with that of his fellows. No submarine skipper rates himself as more valuable than the humblest Seaman 2ndC on his ship. They are a proud lot, our pig boat men, but not boastful. They talk less of their exploits than the public likes. The brasshats apparently have decided to keep it that way. Certain critics, particularly Walter Lippman, believe the strategists in Washington have a long way to go before they will be as smart on undersea warfare as the Germans; this despite the fact that the sub is an American invention.

Maybe we aren't really smart in the way we run this branch of naval warfare, but there can be little criticism of how American subs fight. Prowling the dangerous waters of the western Pacific even to the coasts of Japan they are taking terrific toll of a wily and vicious enemy. One will get you five that when the victory score is at last compiled, the pig boats will be crowding the top.

from the April issue of "Click"

READING-PRATT & CADY

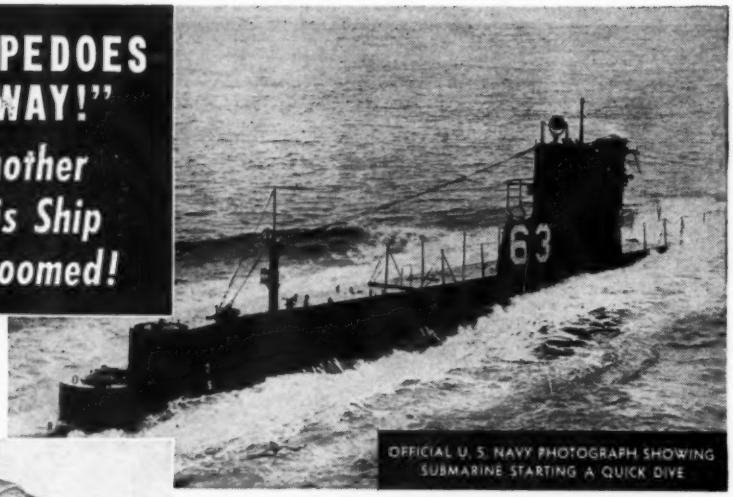
MANUFACTURERS OF

READING CAST STEEL VALVES AND FITTINGS • PRATT & CADY BRASS AND IRON VALVES
D'ESTE VALVE AND ENGINEERING SPECIALTIES

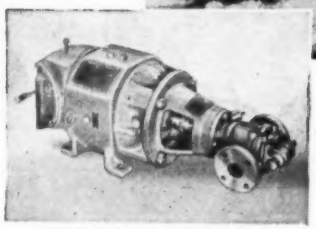
Reading, Pa., Atlanta, Boston, Chicago, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco, Portland

A DIVISION OF **AMERICAN CHAIN & CABLE COMPANY, Inc., BRIDGEPORT, CONNECTICUT**

"TORPEDOES AWAY!" ... Another Axis Ship Is Doomed!



OFFICIAL U. S. NAVY PHOTOGRAPH SHOWING SUBMARINE STARTING A QUICK DIVE


VIKING FUEL OIL DELIVERY PUMP

One of Viking's many War-time jobs is to build fuel oil and lube oil transfer pumps, as pictured here, for submarines of the United States Navy.

This Viking pump is compact in design for use in cramped quarters. It is integrally mounted on the end of the motor and is connected by means of a flexible coupling. It is constructed of a special bronze to resist salt water conditions, with capacity and speed suitable for service performed.

Now just a word to civilian customers. When you are unable to get Viking Rotary Pumps at all . . . or to get them only after considerable delay . . . remember that WINNING THE WAR is Uncle Sam's big job right now . . . that the U. S. Navy has *first call* on Viking's production facilities until Victory is won. Thanks for your patriotism and patience.

VIKING PUMPS — FIRST IN AMERICA

VIKING Pump COMPANY
CEDAR FALLS, IOWA

ECONOMICAL COAL STORAGE - -

Pictured above is a common form of Sauerman scraper coal storage layout for areas of small or medium size. Steel back-posts are spaced at intervals around the outer boundary of the area and the scraper bucket is shifted to different sectors of the yard by moving the tail-block on a bridle cable stretched between the back-posts.

This picture shows Sauerman scraper unit with tail-blocks mounted on a mobile tail tower. This type of installation is designed for handling a large tonnage of coal on a good-sized ground space. Generally, the tower is equipped with a motor and propelling mechanism and movement of the tower is governed by remote control from the scraper operator's station.

with insurance against spontaneous combustion

SAUERMAN Scrapers are on record as handling coal for under 2c per ton at large power plants and for only slightly more at small plants.

This operating economy is just one of many reasons why SAUERMAN Scrapers have become the most widely used equipment for open storage of coal. Other advantages are:

★ Labor is reduced to minimum. From a station overlooking the storage area the operator controls every move of the scraper through a set of automatic controls.

★ First cost compares favorably with other storage systems and upkeep expense is negligible.

★ Machine is adaptable to any ground space regardless of the shape or condition of the area.

★ Scraper piles coal in compact layers. There is no segregation of lumps and fines; no air pockets to promote spontaneous combustion.

★ Each SAUERMAN installation is a permanent, trouble-free investment.

Write for Catalog

SAUERMAN BROS., Inc.
562 S. Clinton Street — Chicago, Ill.

pipe movement of 8 in. To install, the lower half of the guiding cylinder is bolted into place, 2-piece spider is bolted to the pipe, pipe is then insulated, and upper half of the cylinder bolted to the base section. In service, the four "fingers" of the spiders ride on the inside of the cylinder, which is coated with heavy grease to provide true pipe alignment. *American District Steam Co, North Tonawanda, N. Y.*

Fire Extinguisher

C-D/FOG fire extinguisher may be listed in the classification of "non-freeze" extinguishers. Discharge from the extinguisher said to leave no trace on the

finest mechanism or material. Fires in oils, greases, flammable liquids can be quickly controlled with this unit, according to the company. *The General Detroit Corp, 2200 East Jefferson Ave, Detroit, Mich.*

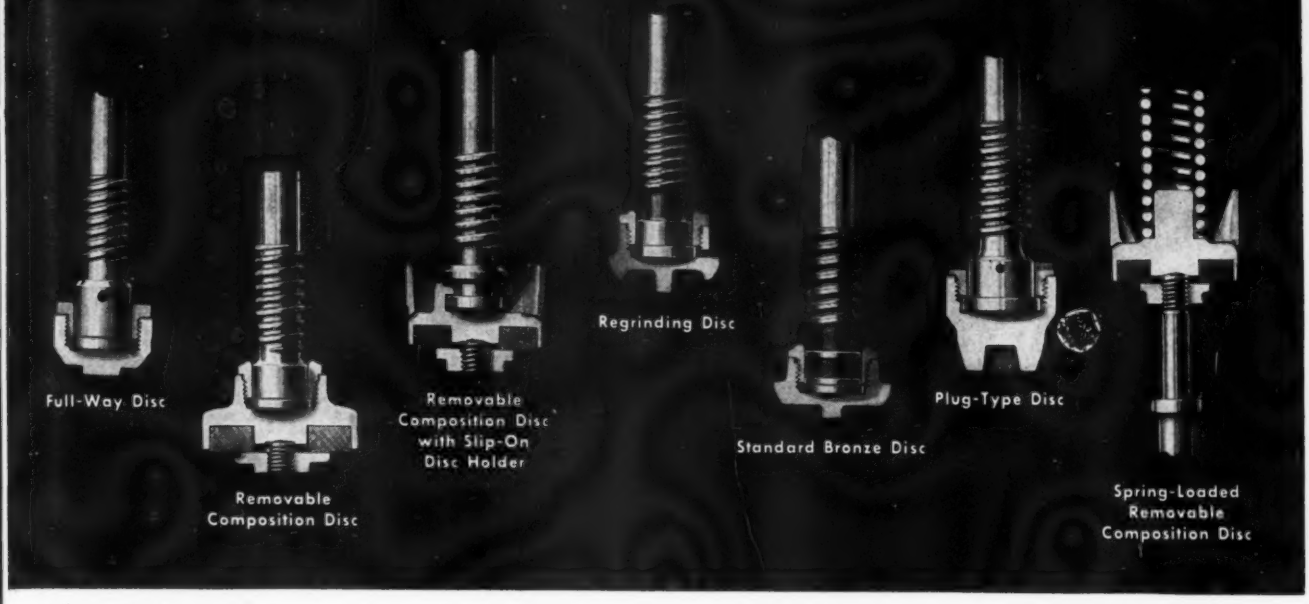
Asbestos Cement Locker

NEWLY DESIGNED durable highly efficient lockers are now being made with Careystone (asbestos-cement) flat sheathing. This material is said to provide the best substitute for metal, since it is produced by combining selected portland cement and asbestos fibers under pressure, resulting in a stone-like substance which will not rust, rot or corrode, and is fire and rodent proof. Material recommended for lockers is available in sheets 48x96x3/8 in. *The Philip Carey Mfg Co, Asbestos-Cement Products Dept, Cincinnati, Ohio.*

Protecting Coating

UCILON is surface coating material said to stand up under many of industry's most corrosive conditions. Because Ucilon is formulated with new and improved synthetic resins, it is said

GLOBE VALVE DISCS



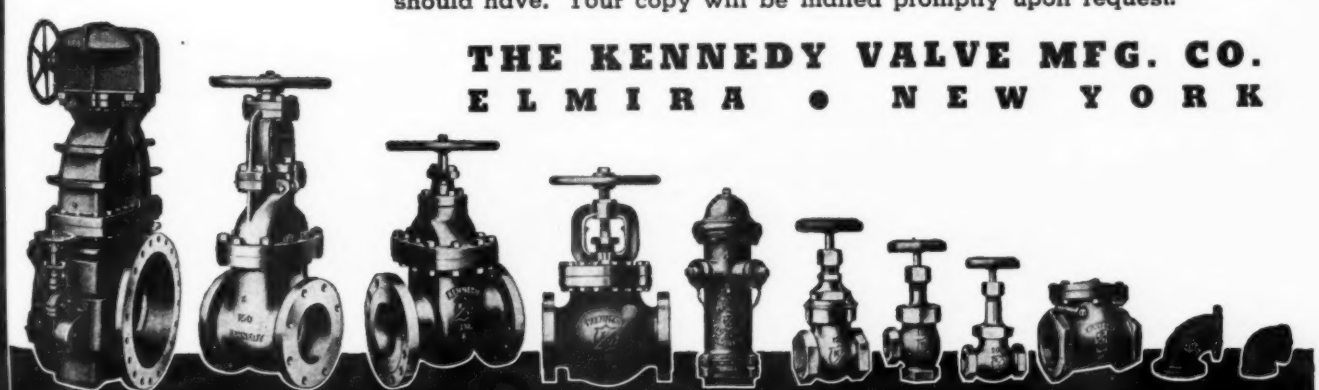
WHICH DO YOU PREFER?

They're all in the KENNEDY line

● Precisely the right discs for all regular requirements are included in the large Kennedy line of Bronze Globe and Angle Valves. Whether the service involves high temperature, high pressure, extreme throttling, severe wear, or other operating conditions, you will find a Kennedy disc design that assures best results and longest possible wear. Kennedy Bronze Check Valves, too, are made with a variety of discs for a wide range of requirements.

While it may be difficult for you to obtain bronze valves today, it will be advisable for you to bear in mind the exceptionally large extent of Kennedy Valve designs, for the Kennedy line of iron body gate, globe, angle and check valves is similarly extensive. All of the many types of Kennedy Valves and Pipe Fittings are described in a comprehensive and conveniently arranged 240-page catalog which every engineer should have. Your copy will be mailed promptly upon request.

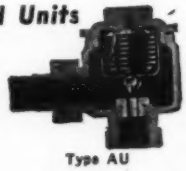
THE KENNEDY VALVE MFG. CO.
ELMIRA ● NEW YORK



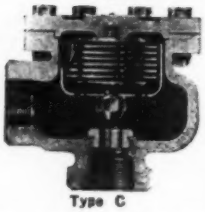
KENNEDY *valves... pipe fittings... fire hydrants*

Type A

★ No Water Logged Units
★ No Adjustment Needed
★ No Air-Binding
★ No Freeze-Ups
★ No Dribbling


Type AU

Type B


Type C

5 BIG ADVANTAGES OFFERED USERS OF NICHOLSON *Thermostatic Industrial* TRAPS

All types drain completely and automatically . . . same adjustment used for any pressure, vacuum to maximum allowable . . . discharge air as efficiently as water . . . complete drainage when cold prevents freezing . . . closes immediately when steam contacts bellows. Five types, sizes 1/4" to 2", pressures up to 300 lbs. Bulletin No. 242.

Also

INVESTIGATE THE ADVANTAGES OF INSTALLING THESE OTHER NICHOLSON SPECIALTIES

Super-Pressure Piston and Weight Operated Traps

Compressed Air and Gasoline Traps

Steam Eliminators

Steam Separators

Welded Floats

Cylinder Control Valves

Send for Bulletins

W. H. NICHOLSON & CO., 125 OREGON ST., WILKES-BARRE, PA.

NICHOLSON *Traps*

THERMOSTATIC ▼ PISTON AND WEIGHT-OPERATED STEAM GASOLINE AND COMPRESSED AIR TRAPS ▼▼▼

CONTROL VALVES ▼ FLOATS ▼ MANDRELS ▼ STEAM AND AIR SEPARATORS

• SAFETY & RELIEF VALVES • PRESSURE & VACUUM GAUGES • SPECIALTIES

Use This Lonergan Model "WTN" top-guided relief valve where *high lift* and *high discharge capacity* are necessary. "WTN" is more than just one valve—it is a whole series of related designs and constructions for steam, air, gases, or liquid service. . . . Lonergan engineers are resourceful "problem-solvers", and have one of the most complete lines of Safety and Relief Valves on which to base their recommendations. Submit your problem.

J. E. LONERGAN COMPANY
RACE & SECOND STS.,
PHILADELPHIA, PA.

Lonergan

SIGN OF PROGRESSIVE ENGINEERING!

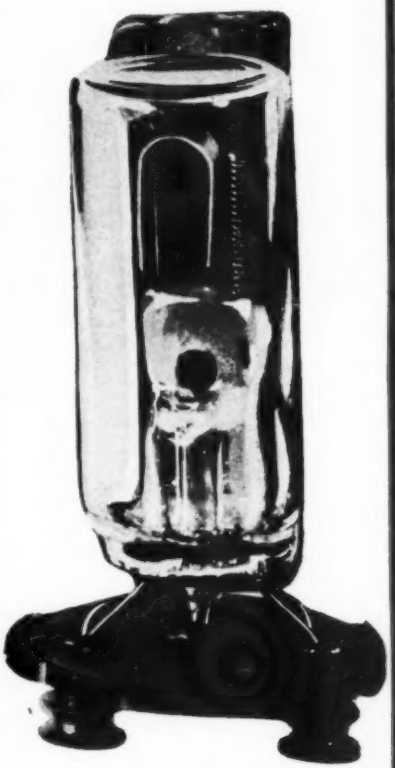
SINCE 1872

• SAFETY & RELIEF VALVES • PRESSURE & VACUUM GAUGES • SPECIALTIES •

to produce tough, flexible coatings resistant to organic and inorganic acids, alkalies, salts, alcohol, gasoline, oils, greases and moisture. It is also claimed to have excellent dielectric strength. Can be readily applied to wood, metal, concrete or other surfaces by brushing, spraying or dipping. *United Chromium, Inc, 51 E 42nd St, New York, N. Y.*

Glow-Type Fluorescent Starter

COMPANY INTRODUCES glow-type starter, GLOSTAT, to augment its line of fluorescent lamp starters. According to the company, the construction of this



starter allows it to take severe punishment from a failed lamp and it is claimed it will show long life in service. It is available for use with 15-, 20-, 30- and 40-watt lamps. *Sylvania Electric Products, Inc, Salem, Mass*

Battery Retainer

PLASTIC STORAGE BATTERY RETAINER made from polystyrene for use in certain types of Exide batteries announced by the company. Retainers are a part of the separation or insulation between positive and negative plates of a battery and act principally to retain the active material in the positive plates. The new retainer not only has technical advantages, but is also said to be more permanent than the former type of retainer. In addition, as now being

Wilson Trigger-Power Cleaner with Wilson Vibromatic Attachment

HERE'S SOMETHING THAT'S REALLY NEW IN TUBE CLEANERS

(Patents Pending)

Wilson Trigger-Power Tube Cleaner

The Wilson Trigger-Power Cleaner is an entirely new and revolutionary type of tube cleaner, especially designed to clean the small diameter (3/8" I.D. to 1 1/4" I.D.) straight tubes of condensers, heat exchangers and similar apparatus *quickly, thoroughly, safely* and *without damage*. It removes either soft, gummy, or moderately hard deposits from small diameter straight tubes at speeds never before attainable, and renders obsolete the old method of using ordinary tube cleaners operating at slow speeds and equipped with ordinary tube "drills". Its use makes possible the rapid cleaning of tubes heretofore considered unprofitable to clean because of the time and trouble involved. In addition, tube bundles can often be cleaned without removal from the shell.

For cleaning tubes which are partially or totally plugged with especially hard deposits such as "petro-coke", hard silica scale, etc., the use of the Wilson Vibromatic Attachment in conjunction with the Wilson Trigger-Power Cleaner makes the operation remarkably easy and rapid. The Attachment gives the special Wilson "Cutter-Bit" the combined movement of a rotary tube cleaner and a percussion hammer. It adds a series of rapid blows to the rotation of the "cutter-bit" and at the same time enables it to obtain a good "bite" on the deposit. This dual-action of the "cutter-bit" quickly breaks up and removes the hardest and heaviest deposits. The Wilson Vibromatic Attachment is operated by the air or steam used as scavenging agent for cleaning the tube of debris, and its use in no way reduces the power of the Trigger-Power Cleaner's motor.

Send for Bulletin No. 63 which fully describes this remarkable tube cleaner.

INVEST IN AMERICA! BUY WAR BONDS AND STAMPS!

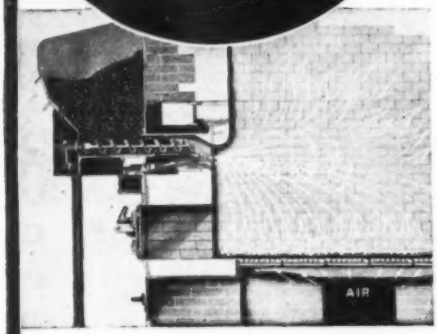
THOMAS C. WILSON, Inc.

PIPE AND TUBE CLEANERS EXCLUSIVELY

THE WILSON BUILDING

21-11 44TH AVE. LONG ISLAND CITY, N. Y.

Meet EVERY WARTIME FIRING PROBLEM WITH . . .



FYR-FEEDER
MULTIPLE SPREADER STOKERS

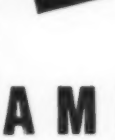
Increase Boiler Capacity — "Fire-over-fire" principle increases capacity with present boilers.

Burn Wide Range of Coals— You can use nearest source of fuel and burn it efficiently with a FYR-FEEDER. Coal from 1½" size to dust; even sawdust or wood chips.

Are Easy to Operate—Simple, easy to understand. An inexperienced man can successfully handle your firing.

Conserve Coal — More efficient burning of fuel produces more steam per pound of coal.

Produce Steam Quicker — Instantly and automatically responsive to sudden variations in load.



WRITE TODAY
For new Catalog describing FYR-FEEDERS

AMERICAN
COAL BURNER CO.
ENGINEERS, Est. 1918
32-18 E. Erie St. • Chicago

manufactured, it uses less critical material. *Electric Storage Battery Co, Philadelphia, Pa.*

Electric Bonder

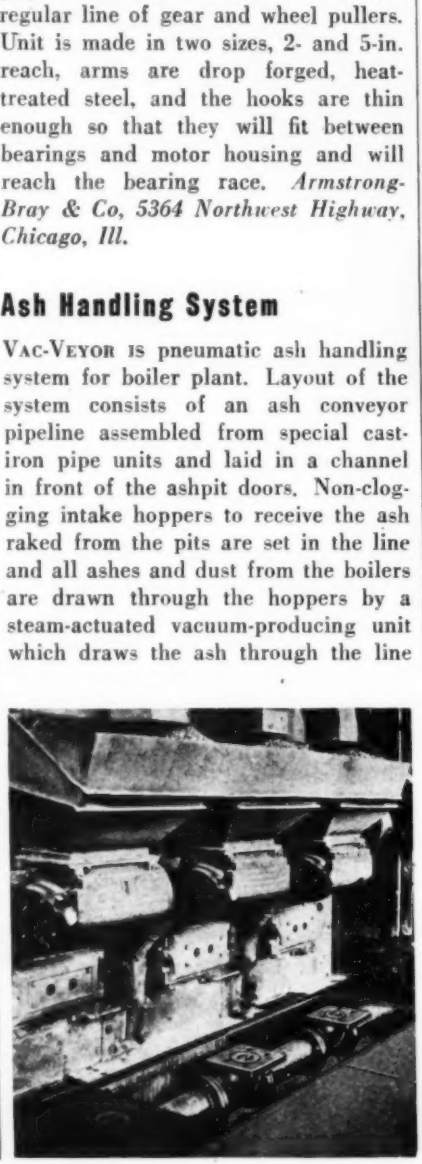
ELECTRIC BONDER is a unit for preparing hardened metal surfaces for metallizing, and operates on 220-v, 60-cycle line. Air-cooled electrode holder permits high-speed bonding without fear of overheating, pre-hardening or distortion. Operator can control the density of metal deposit by controlling air pressure. Pure nickel, Monel, or nickel alloy welding rods or metallizing wire can be used, obtainable in 1,- 2- and 3-ft lengths. *Metallizing Company of America, 1330 W Congress St, Chicago, Ill.*

Pullers

COMPANY ANNOUNCES new bearing and battery terminal puller known as Steelgrip 13 and 13A as an addition to their regular line of gear and wheel pullers. Unit is made in two sizes, 2- and 5-in. reach, arms are drop forged, heat-treated steel, and the hooks are thin enough so that they will fit between bearings and motor housing and will reach the bearing race. *Armstrong-Bray & Co, 5364 Northwest Highway, Chicago, Ill.*

Ash Handling System

VAC-VEYOR IS pneumatic ash handling system for boiler plant. Layout of the system consists of an ash conveyor pipeline assembled from special cast-iron pipe units and laid in a channel in front of the ashpit doors. Non-clogging intake hoppers to receive the ash raked from the pits are set in the line and all ashes and dust from the boilers are drawn through the hoppers by a steam-actuated vacuum-producing unit which draws the ash through the line



Only ONE IMO

The De Laval-IMO Pump is of the rotary displacement class, but has:
- Only 3 working parts,
- No valves,
- No gears,
- No cams,
- Only one packing box (on the suction side),
- Perfect hydraulic balance,
- Perfect rotary balance,
- Freedom from pulsation,
- Suitability for direct connection to motors or turbines,
- Ability to pump any oil in any volume against any pressure.

Ask for Publication I-108.

IMO PUMP DIVISION
of the De Laval Steam Turbine Company
Trenton, New Jersey

HERCULES
Seamless Copper
FLOATS

GUARANTEED
TO STAND UP!

Every Hercules Float carries our guarantee to stand up under 350 lbs. working pressure and 500 degrees temperature.

Fabricated of seamless copper under our special spinning process. Hercules Floats are uniform in thickness and high in mechanical strength.

You can depend on Hercules for floats—in standard shapes up to 10 in. and in special types to your specifications—to give long, dependable, economical service.

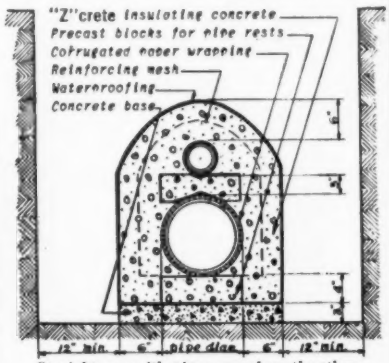
Insure care-free maintenance of water level in your heaters, tanks, reservoirs and other equipment by specifying "HERCULES."

HERCULES FLOAT WORKS
200 Franklin St.
SPRINGFIELD, MASS.

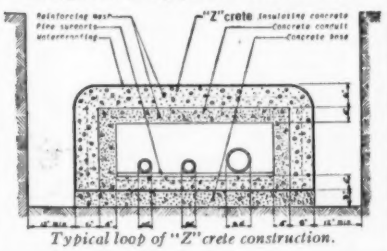
New Way To Insulate Underground Steam Lines

Gives You 6 Outstanding Advantages

Typical straight run with pipes side by side.



Straight run with pipes one above the other.



Typical loop of "Z" crete construction.

"Z" crete System is Fast, Easy, Practical

Provides High Insulation Efficiency, Permanency and Waterproofing

The problem of insulating underground steam pipes is complicated by the fact that keeping water out is very nearly as important as keeping heat in. A high degree of inherent strength is also most desirable to resist settling and to prevent excessive damage during the backfilling operation.

The new "Z"crete System fulfills all of these requirements and a number of others.

Second in importance only to its exceptional insulating efficiency is "Z"crete's continuous monolithic protection against mechanical damage. This also makes for greater efficiency in insulating and waterproofing by eliminating joints. Joints are always weak spots in any underground system, permitting heat to leak out and water to seep in. Monolithic construction also permits unbroken waterproofing to be applied externally, and further protection against absorption is provided by the inherently non-hygroscopic nature of the material itself.

"Z"crete owes its extremely high insulating efficiency to "Z"crete Aggregate, a featherweight, all mineral granular material made by exploding an unusual type of mica. It is chemically inert, fireproof and rotproof, making it especially suitable for underground installations. New "Z"crete literature explains "Z"crete's advantages and also gives complete construction details. It is yours merely for mailing the coupon at right. Why not mail it at once and have this data in your files?

For specifications and engineering data write to:

UNIVERSAL ZONOLITE INSULATION COMPANY
Dept. P5, 135 South La Salle Street, Chicago, Illinois

MAIL COUPON FOR DETAILS

UNIVERSAL ZONOLITE INSULATION COMPANY
Dept. P7, 135 S. La Salle St., Chicago, Ill.

Please send me full information about the "Z"crete systems for underground pipe insulation.

Firm Name.....

Name of Individual.....

Address .....

City.....*State*.....

YOU CAN SEE THE EXTRA STRENGTH AND CLEANLINESS OF

BATES-GRATES

FOR OPEN STEEL FLOORING AND STAIR TREADS

That BATES fillet weld gives you the full strength of the original steel of main and cross bars, *without dirt-catching overflow of surplus metal around the fillet.* That's important.

Just as important, note that crisp, clean tread the entire length of cross bar—a feature you can get only with BATES Hex Cross Bar construction.

You can have these definite advantages at no extra cost by specifying BATES-GRATES for *your* flooring.

8½" x 11" BOOKLET GIVES DETAILS. SHOWS MANY INSTALLATIONS

•

WRITE FOR COPY

WALTER BATES COMPANY, INC.
JOLIET, ILLINOIS
OPEN STEEL FLOORING • STAIR TREADS

to an outside storage silo which is provided with discharge gate for truck or railroad car removal. Flyash and soot lines can be led into the same ash conveyor line. *Beaumont-Birch Co, Philadelphia, Pa.*

Strainer

STRAINER FOR HANDLING highly viscous liquids or liquids that are solid at room temperatures has been announced by the company. Steam-jacketed strainers are used to maintain the liquid in the strainer at the same temperature as in the piping and were developed primarily to speed the handling of difficult liquids. Standard capacities are 20, 50, 100 and 200 gpm, pipe sizes, 1, 2 and 3 in. Maximum operating pressure is 50 psi at 600 F, and the jacket is suitable for 125 psi steam pressure. The bottom and sides of the unit are completely inclosed in a steam jacket, while two inlet and two outlet ports are provided for steam line connection. *Blackmer Pump Co, Grand Rapids, Mich.*

Pipe and Stud Extractors

EXTRACTORS GRIP without hammering or pounding, and 4-point grip assures strong bite and prevents extractor from reaming. To remove a broken piece of pipe the extractor is inserted straight

Your Blueprint for

MORE POWER

starts with

OAKITE CLEANING

. . . Expediting Your Air Conditioning Maintenance Work

Effective maintenance of air conditioning equipment is a wartime MUST to make it LAST LONGER and FUNCTION BETTER! And the FIRST STEP is thorough, periodic cleaning!

Do this essential work the easier, time-saving, more effective Oakite way. Specially designed Oakite materials are available not only for safely, thoroughly removing impinged deposits from washable air filters, but also for handling such other jobs as descaling water-cooled compressors, and conditioning re-circulating water supplies.

Service Report *FREE!*

Based on successful experience, this NEW Special Service Report will HELP YOU expedite, speed-up and economize on air conditioning maintenance. Send for your FREE copy TODAY!

OAKITE PRODUCTS, INC.
23 Thames Street, New York, N. Y.
Technical Service Representatives Located in All Principal Cities of the United States and Canada

OAKITE *Specialized cleaning*

Buy Bonds for Victory

MATERIALS & METHODS FOR EVERY CLEANING REQUIREMENT

Now Ready!

THE NEW DARLING VALVE CATALOG FOR ALL INDUSTRIES

with

Complete Up-To-The-Minute General Data and Specifications for use in your Plant Design, Construction, and Maintenance

THIS new Darling Valve Catalog is actually *more* than a catalog—it's a handbook of informative data and valuable information which you will have occasion to use, time and time again. Compiled and edited only after years of research and practical experience, this book will prove most valuable in the purchase and maintenance of valves in your plant.

You can know in advance what valve designs and materials will best fit your needs for various services. You can know why certain mechanical features make valves last longer—operate easier—give positive shutoff—cost less to maintain. You can also know why so many industries, for so many years, have insisted upon Darling Valves for critical plant installations.

In This Catalog . . .

Over 500 photographs, sectional views, designs, detailed drawings and other highly interesting illustrations are shown

•

Over 300 pages of descriptive data and specifications are indexed and cross-indexed for ready reference.

•

More than three years of time and energy have been expended in the creation and completion of this material

•

Technical contributions include the finest valve engineering talent available

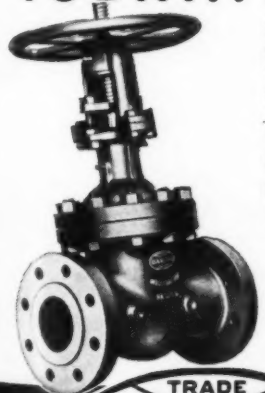
•

A total of more than 125 working days went into one single phase—that of proof reading.

•

Each book is registered and recorded in the name of the recipient and his company

SEND FOR YOUR COPY TODAY. .



It's ready now! Your copy of the new Darling Catalog can be shipped immediately. Simply fill in the coupon and mail to Darling Valve & Manufacturing Co., Williamsport, Pa. There is no obligation.

Darling Valve & Manufacturing Co.
Dept. E, Williamsport, Pa.

Please send me copy of your new catalog. I am particularly interested in:

☐ Corrosion Resistant Valves ☐ Check Valves ☐ Forged Steel Valves
☐ Cast Steel Valves ☐ Bronze Valves ☐ Marine Valves
☐ Special Alloy Valves ☐ Fire Hydrants ☐ Composition Cups

Name _____ Title _____

Company _____

Address _____

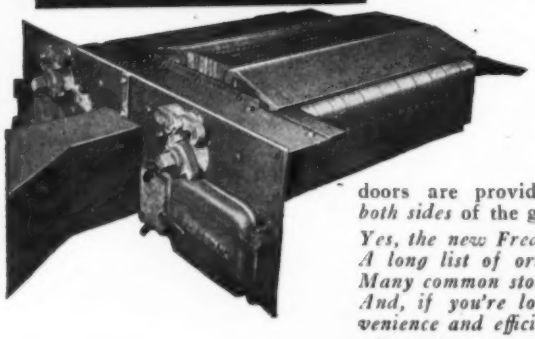
City _____ State _____

TRADE DARLING MARK

VALVE & MANUFACTURING CO.
WILLIAMSPORT, PA.

THE BURNING-END *THAT ENDS MANY COMMON STOKER TROUBLES*

—one of several important new features engineered by FREDERICK!



Frederick Stokers have *more active grate surface,* without dead plates . . . whether furnished with or without side dumping grates.

The specially designed tuyeres have air ports so arranged and proportioned as to insure complete air distribution and maximum combustion efficiency.

And, the wind-box is enclosed to simplify and make a neater installation, and to eliminate efficiency loss through leaky brickwork. *Two* cleanout doors are provided to allow thorough cleaning *both sides* of the grate area.

Yes, the new Frederick Stokers are DIFFERENT! A long list of original features distinguish them. Many common stoker problems are solved by them. And, if you're looking for maximum thrift, convenience and efficiency, we suggest you investigate.

All details upon request; no obligation.

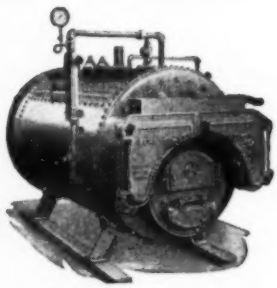
FREDERICK STOKERS

THE FREDERICK IRON & STEEL COMPANY • FREDERICK, MD.

COMPLETE LINE OF CENTRIFUGAL PUMPS FOR ALL PURPOSES
STEAM OPERATED ASH CONVEYING SYSTEMS • ASH STORAGE BINS

KEWANEE SCOTTIE JR BOILER

5 SIZES FOR SMALL INDUSTRIAL USAGE



• High Pressure steam with this low cost boiler designed for economical operation. Compact, yet easily accessible.

For 6" scale with pipe diameter markings, write, Dept. 99K—V11

KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS
Division of AMERICAN Radiator and "Standard" Sanitary Corporation

ALLPAX

THE PACKING THAT "PACKS ALL"

. . . use it once and
. . . you'll use it always

Here's the universal packing that can be used for any fluid or on any apparatus. One size packs all—economically, efficiently—tightly—simply.

Try ALLPAX and you, too, will be enthusiastic over its easy application and long wear. You don't have to remove old packing to repack with ALLPAX. Square cross section makes ALLPAX easy-filling in any stuffing box.

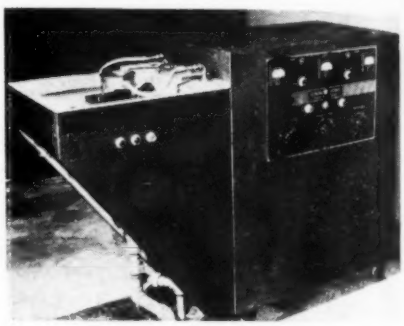
Try it and you'll always use it. Full details on request.

THE ALLPAX CO., INC.
Mamaroneck, N. Y.
•
Distributors Everywhere

into the pipe so all four points bite at the same time. The extractor is turned with a wrench in the direction of the extracted threads, or in the opposite direction of the threads on the broken teeth. In removing studs, screws or bolts a hole must be drilled in the exact center of the broken part deep enough for the extractor to get its grip. The extractor is inserted straight into the bored hole so that all four points grip equally and the extractor is turned with the wrench in the opposite direction of the threads on the broken part. *Reps Tool Co, Inc, 82 Wall St, New York, N. Y.*

Electronic Heaters

ELECTRONIC HEATERS for high-frequency induction heating of metal parts for brazing, soldering and selective heat treating has been announced. Essentially power oscillators which convert 60-cycle power to high-frequency power at approximately 500,000 cycles, the



electronic heaters are available in two standard sizes—one having an output of 5 kw and the other an output of 15 kw. Simple circuits are employed and the necessary electronic tubes, controls and other equipment are arranged in completely inclosed cabinets. Use of conservatively rated elements reduces maintenance to the periodical replacement of tubes, which then properly applied have an average life expectancy of 5000 to 10,000 hr. *General Electric Co, Schenectady, N. Y.*

A-C Welder

AMPAC "200" WELDER said to give the operator automatically correct voltage for the continuous range of currents available, rather than use an almost constant voltage at all current settings. This adjustment not only makes welding easier at low currents because of the high striking voltage, but saves power when welding at high currents because the voltage is low. Other special design and operating features of unit include new integrated reactor-transformer construction which provides a high, yet safe voltage for easy

GOLDEN-ANDERSON SPECIALTY VALVES

To insure uniform terminal pressure

THE G—A STEAM PRESSURE REDUCING VALVE

APPLICATION—The G-A Steam Pressure Reducing Valve is particularly well adapted to intermittent and dead end services. It will hold adjusted delivery pressure at all times under any necessary flow capacities.

CONSTRUCTION—Double extra heavy construction throughout . . . thus there is no warping or distortion under pipe line stress and strain. Valve trim may be Bronze, Monel Metal, Stainless Steel or Gallavoy, according to pressure and temperature conditions.

ASSEMBLY ARRANGEMENT — Valves may be furnished with either Base Type or Globe Type Pilot Control. With the Globe Type Pilot Control the valve may be arranged remote from main valve or in any position piped adjacent to main valve. Balanced pilot valve sensitively maintains downstream pressure under varying flow demands. Singled seated type main valve prevents downstream pressure building up under no service consumption. This valve will efficiently handle 125 to 400 lbs. of saturated or superheated steam. It is furnished in sizes from 2½" to 12".

GOLDEN-ANDERSON builds a complete line of Specialty Valves . . . valves to meet your special needs . . . including Altitude Valves, Emergency Stop Valves, Steam and Water Pressure Reducing Valves, Check Valves, Float Valves, etc. Our new catalog gives complete specifications on all G-A Valves . . . write for it today.

GOLDEN-ANDERSON VALVE SPECIALTY CO.

FULTON BLDG. **PITTSBURGH, PA.**

welding at low currents; active duty from every line of flux assured by reactor coils which surround the variable air gap, and simplified construction using fewer working parts, cutting maintenance down to routine lubrication twice a year. Increased welding capacity in one machine is also offered by the company. *Allis-Chalmers Mfg Co, Milwaukee, Wis.*

Color and Hardener for Concrete Floor

DYE-CRETE color hardener eliminates etching to neutralize the alkaline content of concrete. Color hardener is available clear and in six colors. Coverage should range, according to the company, between 250 and 400 sq ft per gal, depending on the surface. *Wilbur & Williams Co, Park Square Bldg, Boston, Mass.*

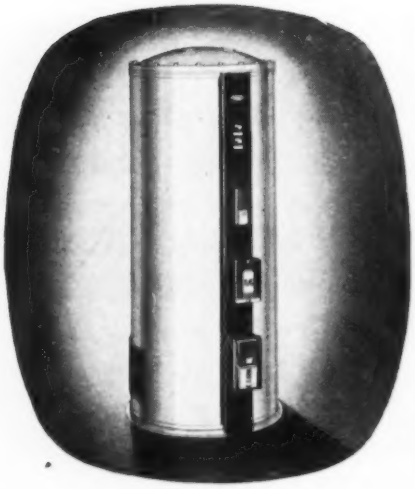
Volocitrol

VOLOCITROL has been designed to provide positive and adjustable control of air volume, pressure and distribution across a supply outlet. The frame of

the unit is of 16-gage steel and friction pins on each louver allow it to be set by hand. A fireproofed felt edging strip to fit between the frame of the unit and the duct is furnished as standard. *Barber-Colman Co, Rockford, Ill.*

Motor Starter

TYPE H MOTOR STARTER is metal-inclosed structure similar to metalclad switchgear. High interrupting capacity disconnecting-type fuses utilized in



Successful

PURIFICATION

of all types of Industrial oils is guaranteed by

HONAN-CRANE "CONTINUOUS" OIL PURIFIERS

Honan-Crane "*Continuous*" Oil Purifiers are now operating in every field where oil is being used. We can give you complete information as to the technique of application and the results accomplished by the purification of any kind of Industrial Oil.

COMPLETE LIBRARY ON OIL PURIFICATION — The following material can be obtained by writing on your company letterhead:

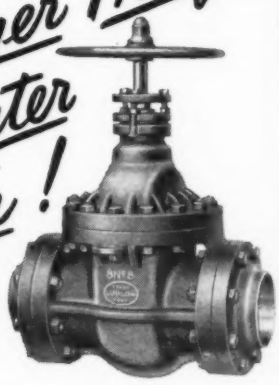
BULLETIN 100M—Purification of lubricating oil for Gas and Diesel engines up to 10,000 H. P.

BULLETIN 300T—Purification of lubricating oil for Turbines and Hydro-Electric Generators.

17 ENGINEERING BULLETINS with the latest information on purification of: Hydraulic oils, Insulating oils, Cutting oils and coolants, Diesel Fuel oils, Roller Backup oils, Compressor oils, Ice Machine oils, Quenching oils, Honing and Lapping oils, Switch oils, Power Transmission oils, Treated Turbine oils, Bearing oils, Engine Test and Run In oils, Oil Purification Temperatures, Cranite Refill Element.

Honan-Crane
CORPORATION
1200 SIXTH STREET
LEBANON, INDIANA

Longer Thrift-Shorter War!



Many an American is stretching living allowances and buying bonds with the difference. And many an engineer is stretching the service of rugged old Ludlows so that more Ludlow production can go into vital war use. Engineering generalship suggests two ways — by properly maintaining their power systems to put idle valves to work—by renewing old, cast-off valves with replacement parts.

Ludlow Valves have always been designed for maximum endurance—so, maintenance and restoration is not unduly expensive. Ludlow will gladly undertake to furnish necessary replacement parts.

THE LUDLOW VALVE MFG. CO., INC.
TROY, NEW YORK

Construction Features: Self-releasing 30° angle wedges and free-floating gates, self-adjusting to seats, afford smooth, trouble-free performance, long service. Rings are cleaned throughout stroke action. Gates are wedge-locked directly opposite ports and completely unwedged before raising. Ample tolerances provide easy action. Simple construction permits easy replacement of parts.

V-12

LUDLOW VALVES
SINCE 1866

Edge Moor

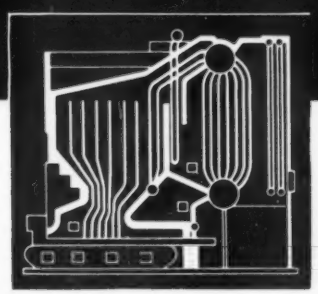
EXPERIENCE IN DESIGN of WATER TUBE BOILERS

a prerequisite to efficient performance . . .

Fifty years of continuous service designing and erecting steam generating plants all over the world has created a background of exact engineering knowledge and skill within the Edge Moor organization.

Edge Moor designs are produced in fully equipped Edge Moor shops under ideal conditions of close relationship to our engineering departments. Year after year, improved machinery and shop methods have made possible the highest class fabrication necessary to withstand unusual and unexpected contingencies and demands.

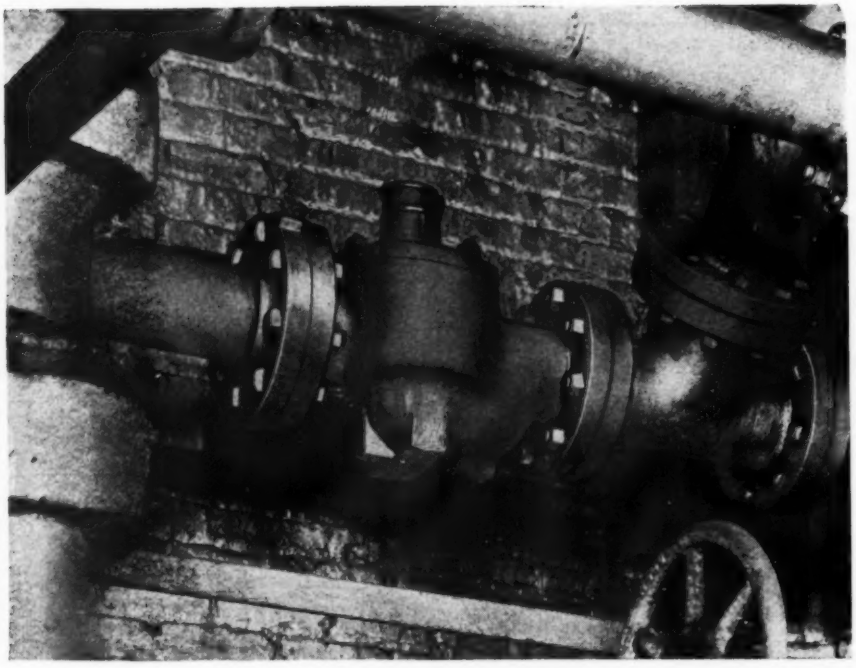
Any one of the 5,000 owners of Edge Moor installations will recommend the purchase of Edge Moor Water Tube Boilers.



Edge Moor **IRON WORKS, INC.** EDGE MOOR DELAWARE

NEW YORK—30 ROCKEFELLER PLAZA . . CHICAGO—#1 NORTH LA SALLE STREET

IN CANADA - UNITED STEEL CORPORATION, LIMITED, TORONTO



Serving in WAR as in PEACE!

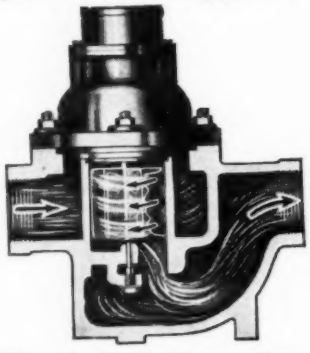
The Henszey Meter shown in action was installed to measure boiler blowdown in the power plant of a large manufacturer. Other meters had failed one after another due to the corrosive action of the hot dirty blowdown. But the Henszey Meter stood up under the conditions that were the downfall of the others.

Today—under the heavy burden of full-time war production this Henszey Meter is still on the job—putting in more hours—but still accurately measuring the blowdown.

There are hundreds of Henszey Meters serving in many war industries. They accurately measure boiler feed water, condensate, free running chemicals and other hard to measure liquids in addition to boiler blowdown. They are equally accurate at high or low flow—high or low pressures—on reciprocating or centrifugal pumps. Sizes from 10 g.p.m. to 1200 g.p.m. cold water steady flow rating. Pipe connections ¾" to 6"—special sizes to order. Calibrations can be made to read in gallons, pounds or cubic feet at any specified temperature. The meter is easily installed right in the line.

Write today for full information—please give details of your problem to save time.

HENSZEY COMPANY
DEPT. D7 WATERTOWN, WIS.



Here's how it works

Water enters the measuring chamber tangentially, spinning in the chamber as it passes through, forming a vortex. Each gallon that passes through this chamber makes the same number of revolutions of the water. A vane is placed in the rotating water to impart this rotation to the register. A minimum of working parts without close clearances.

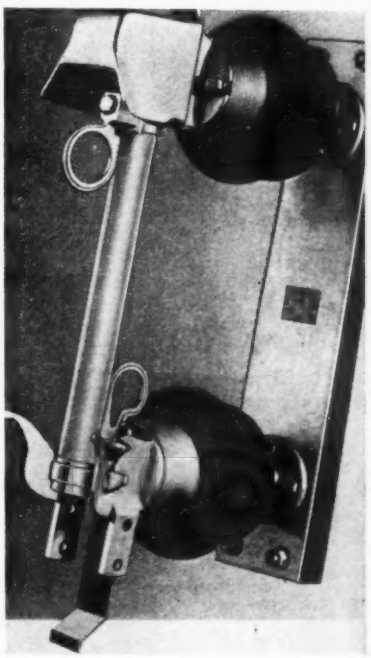
HENSZEY
BOILER FEED WATER
METERS

HENSZEY BLOWDOWN SYSTEMS
Boiler Feed Regulators • Flow Indicators
Proportioning Valves • Heat Exchangers

combination with a heavy duty oil switch. Units have been developed for both induction and synchronous motors rated up to 1000 hp at 2300 volts and 1750 hp at 4600 volts, 3-phase, 50 or 60 cycles. Starters can be used for full- or reduced-voltage starting, dynamic braking, reversing, or special applications. Short circuit protection up to 160,000 kva at 2300 v and 320,000 kva at 4600 v eliminates need for a backup breaker within these kva ratings. Disconnecting type fuses, combining high interrupting capacity with fast-clearing action, hold short-circuit currents to safe values which do not damage the control. *Allis-Chalmers Mfg Co, Milwaukee, Wis.*

Boric Acid Fuse

FOR OUTDOOR POWER SYSTEMS weather-protected intermediate duty boric acid fuse interrupts the circuit to faulted equipment and isolates fault from feeders with a complete 180 deg air break. In the new DBA-1 fuse the blown fuse unit is dropped out of the circuit after the fault current is interrupted. Thus there is no possibility of burning con-

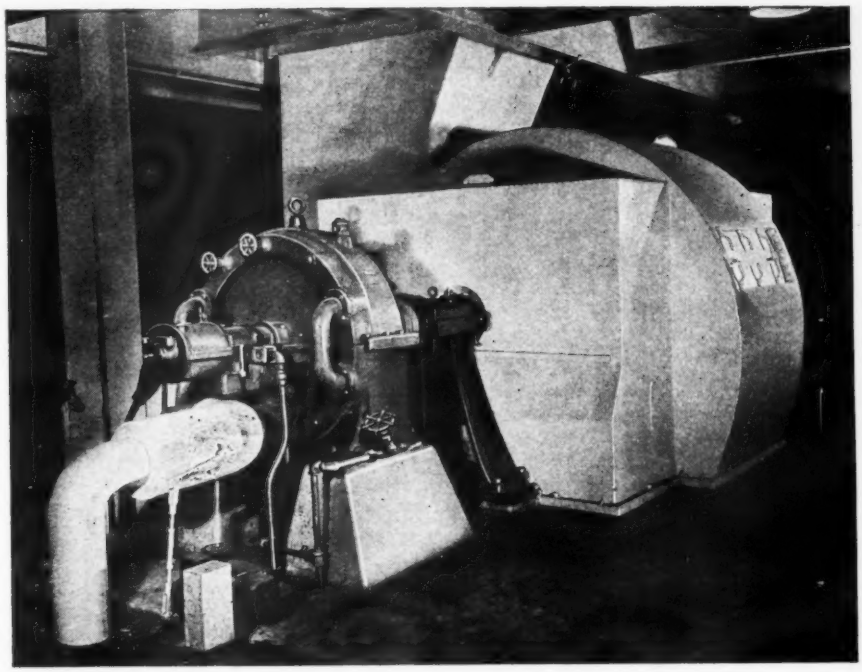


tacts or arcing betwwen fuse tube and clips, or of any carbonized fuse parts breaking down to produce leakage or a second fault. Other features are the "de-ion" boric acid arc quenching action and the sleetproof ejector machanism for all-weather operation. *Westinghouse Electric & Mfg Co, East Pittsburgh, Pa.*

Wire-Reinforced V-Belts

COMPANY ANNOUNCES PRODUCTION of wire-reinforced V-belts in two types:

TERRY



BUCKETS AND ROTOR IN THE TERRY WHEEL TURBINE

. . ALL IN ONE PIECE

In the Terry Turbine the wheel is made from a single forging of special composition steel. The buckets are milled directly in the wheel. There are no parts to become loose or work out. Such construction makes for long life and low maintenance.

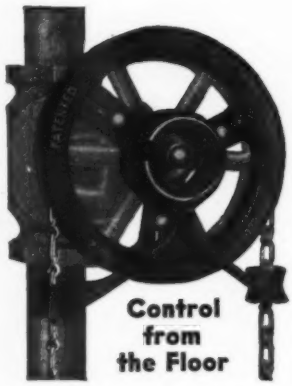
This and many other features of Terry Wheel Turbine design are described in our Bulletin S-116. A request on your business letterhead will bring a copy.

ABOVE: 250 H.P. Terry Wheel Turbine driving Induced Draft Fan. Unit is one of ten Terrys installed in a mid-western plant.

T-1153

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.

Make Your Overhead Valves SAFE And Easy to Reach---



With the Babbitt Rim for Valves you eliminate danger and banish the step ladder. You can now place your valves wherever they come economically and conveniently. They fit any valve. Let us tell you more about them. Write today.

BABBITT STEAM SPECIALTY CO.
New Bedford, Mass.

NO DELAYS

PLASTIC PATCH

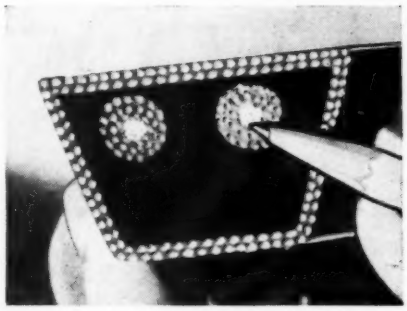
Takes Traffic Immediately . .

No traffic interruptions when you patch broken concrete with durable INSTANT-USE. Material comes ready mixed. Simply shovel into hole, tamp and run traffic over immediately—without waiting. Bonds tight to old concrete. Makes smooth, solid, lasting patch. Withstands extreme loads. Keep a drum on hand for emergencies. Immediate shipment.

Request Descriptive Folder

. . . and Details of
FREE TRIAL
OFFER

INSTANT-USE
FLEXROCK CO., 2377 Manning St., Phila., Pa.



a cable cord construction and a grommet construction which incorporates a wire cord placed in the center of a cotton or rayon grommet. Designed for the most rigorous services, advantages of the wire reinforced V-belt are said to be greater horsepower capacity, increased tensile strength and low stretch. *B F Goodrich Co, Akron, Ohio.*

Automatic Storage Water Heater

TO CONSERVE CRITICAL MATERIAL the company created the "American-Victory" and substituted non-metallic parts for various metal parts. Iron has replaced aluminum, copper and brass and highly polished chromium trimmings have been eliminated. The jacket is a tough, non-metallic insulating material and presents the finest substitute available for the customary steel jacket—saving an average of 20 lb of steel per heater. Both the tinned brass drop tube and the brass drain cock that were standard parts of the peace-time model have been eliminated. Four pounds of iron and steel have been saved by manufacturing the new door of pressed steel and by using non-metallic legs. Newest unit is made in four sizes, 15, 20, 30 and 40 gal capacity. On all orders for "American" water heaters company will supply the "American-Victory" model. *Hotstream Heater Co, Cleveland, Ohio.*

Vibrating Reed Frequency Meter

J-B-T VIBRATING REED FREQUENCY METER is being used extensively on engine generator sets, in many types of electronic equipment on panel and control boards in central stations and industrial plants because of its new and exclusive features. There are no delicate pointers, pivots or jewels—no intricate movements in the meter. The meter consists of a case, base, dial, central mounting frame, a series of spring steel reeds, screwed to a reed mounting bar, an individual driving coil surrounding each bank of reeds, a permanent magnet, a series resistor

No Shutdowns necessary for

SOOT or SCALE REMOVAL

XZIT

works while your boilers operate

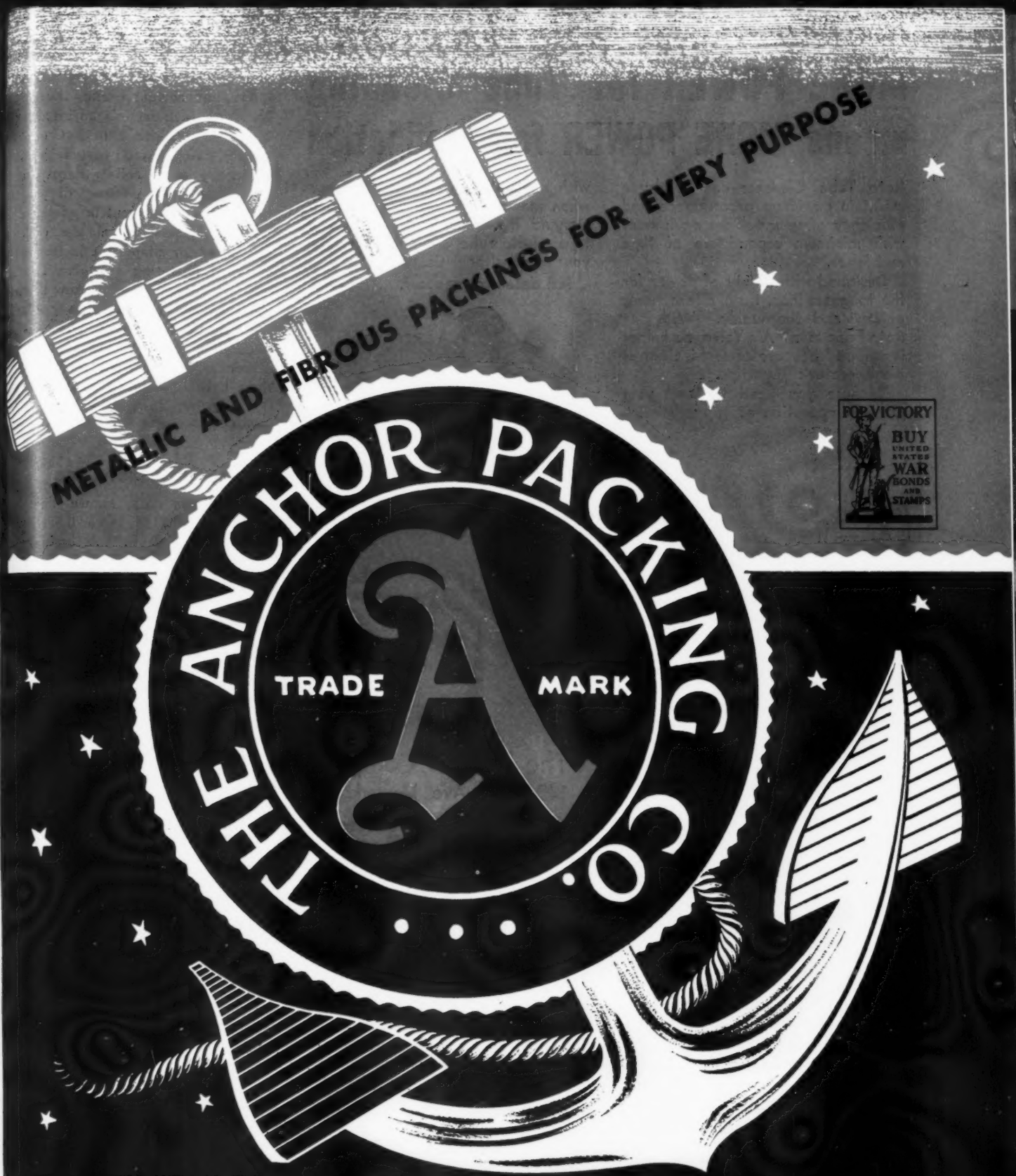
No Time Lost...

Easy to Use...

XZIT, a scientifically formulated chemical compound, offers you a simple, sure methed of counteracting the damage, the serious production set backs, that carbon deposits on boiler heating surfaces, uptakes, breechings and stacks provoke. XZIT not only makes it easier to remove soot and fire scale—it discourages their further formation. All while your boilers operate!

Harmless to metal and brick.

XZIT SALES CO.
1031 CLINTON STREET
HOBOKEN, NEW JERSEY



THE ANCHOR PACKING COMPANY

GENERAL OFFICES • PHILADELPHIA, PENNSYLVANIA

FACTORIES: **MANHEIM, PA., ELKHART, IND., MONTREAL, CAN.**

BRANCH OFFICES

Baltimore, Maryland	106 Stewart, Building Gay and Lombard Streets	Montreal, Canada	5575 Cote Saint Paul Road
Boston, Massachusetts	303-04 North Station Building 150 Causeway Street	Milwaukee, Wisconsin	4417 West North Avenue
Buffalo, New York	Andrews Building	New Orleans, Louisiana	418 Common Street
Cleveland, Ohio	523-25-27 Rockefeller Building	New York, New York	100 Sixth Avenue, near Canal
Chicago, Illinois	200 East Illinois Street	Philadelphia, Pennsylvania	401 North Broad Street
Cincinnati, Ohio	4 West 7th Street	Pittsburgh, Pennsylvania	405 Penn Avenue
Detroit, Michigan	169 West Jefferson Avenue	Portland, Oregon	Terminal Sales Building
Houston, Texas	509 Washington Avenue	San Francisco, California	156 South Park
Kansas City, Missouri	1332 Oak Street	Seattle, Washington	2207 First Avenue, South
Los Angeles, California	720 Mateo Street	St. Louis, Missouri	1407 Pine Street
		Tulsa, Oklahoma	823 South Gary Place
		Wilmington, California	207 Avalon Boulevard

MORE POWER for Tube Cleaning means MORE POWER for production

Roto Tube Cleaners can help you maintain maximum performance and efficiency of your tubular equipment with minimum expenditure of time and labor.

Designed with plenty of power for the toughest jobs, Roto cleans tubes quickly and thoroughly. With the Roto "one-man" Air Valve, no helper is required because control is right at the operator's fingertips.

Because you need to keep your plant in operation at top efficiency with a minimum of down time now, when maintenance crews are undermanned, it will be to your advantage to put Roto Tube Cleaners to work in your plant without delay.

Full details on request.

The **ROTO** Company
145 Sussex Ave., Newark, N. J.

ROTO
Tube Cleaners

Write for Working Sample
Send for 36 page catalog.

Put "AMBEST" to a long life test on any tough job

This UNIVERSAL packing—of long, pliable, anti-friction metallic alloy strands—assures low cost, long life packing protection and easy application on any rod in good condition. "AMBEST"—available for all pressures and temperatures up to 550° F.—is recommended for pumps, compressors, engines, throttles and valve stems. All needs are supplied by one packing when you use "AMBEST."

"EUREKA"

EUREKA PACKING CO., 294-296 46th St., BROOKLYN, N. Y.

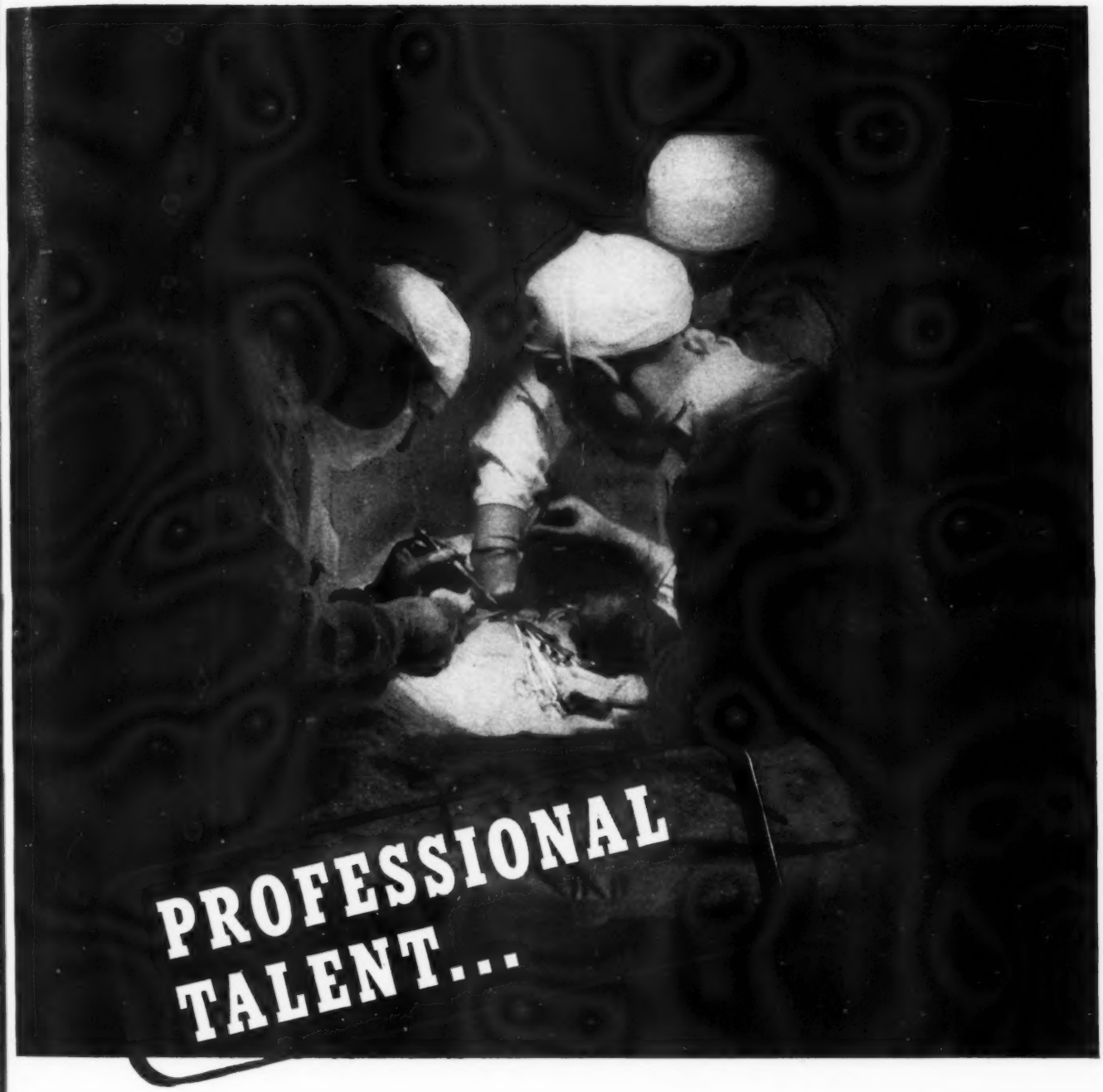
and terminal studs. In operation the alternating current excites the driving coil. As each reed is adjusted to respond by resonance to but one frequency, the one reed in tune with the frequency in the coils will respond by vibrating rapidly because of polarization by the permanent magnet and induced magnetism from the coil. A series resistor adopts the instrument to specified operating voltage. The frequency of the current can be read opposite that reed on the graduated face of the instrument. As the reed mounting bar of the instrument is not a "rocker" but is fixed, external vibrations have little effect on reed activation. *J-B-T Instruments, Inc, New Haven, Conn.*

Fire Extinguisher Case

EXTINGUISHER CASE, known Tampless, is of non-critical tough cardboard stock and safely houses a fire extinguisher from unauthorized persons, while allowing instant removal for legitimate use. One quick pull on a sealed string breaks through gummed-paper sealing strip and permits case to unfold. Extinguisher can immediately be removed from its bracket. The case can be reused by simply reservicing the extinguisher, replacing it on its bracket, folding the case and resealing it. *American-LaFrance-Foamite Corp., Elmira, N. Y.*

Sight Flow Indicator

SIMPLY-CONSTRUCTED FLOW INDICATOR clearly shows when liquid or gas is passing through line. Also has an indicating float which moves up and down in tube in direct proportion to amount of flow. Instantaneous response to flow change is obtained by the uniquely designed Pyrex tube into which triangular V-ported flutes are formed. As a result a variable area meter is obtained giving a wide range over a short scale length. The unit is particularly sensitive to low flows and informs the operator the very second the flow starts. Metering tube is only



The work of the water conditioning specialist may not be as spectacular as that of the surgeon, but these activities have a common denominator of training, knowledge and skill.

There are wide fields for the application of professional talent in the conditioning of boiler feed water. Under today's conditions the prevention of scale, corrosion, embrittlement and carryover is a subject of particular importance. Betz engineers and chemists have had years of experience with all types and sizes of installations and with widely varying feed waters. Our service is complete for all industries, with individual recommendations for each client.

We have laboratories and engineers located throughout the United States and Canada.

W. H. & L. D. BETZ
FRANKFORD • PHILADELPHIA • PENNA.

BETZ

● **CHEMICAL ENGINEERS AND CONSULTANTS ON ALL WATER PROBLEMS**

B-H INSULATING CEMENT

Test blocks show the difference between corrosive action of B-H INSULATING CEMENT and ordinary insulating cement.

HAS LICKED CORROSION

Rust takes it on the chin!

A perfect bond — that's the beauty of Baldwin-Hill Insulating Cement. How often have you found that moisture in ordinary insulating cement sets up a rusting action releasing the bond, causing peeling and falling?

B-H Insulating Cement is non-corrosive, whether it dries immediately on a hot surface or is allowed to air-dry over a long period of time. On application involving wire this is more important than ever with galvanizing "out" for the duration.

With the famous B-H *black* rock-wool as a base, B-H Insulating Cement is the ideal maintenance insulation effective up to 1800° F. Mixed with water the tightly rolled pellets of wool do not lose their physical form, and so the countless number of entrapped dead air cells within these pellets provide maximum insulating efficiency. B-H No. 1 is easy to apply because it has an exceptionally high adhesive characteristic, and gives high coverage with a very minimum amount of shrinkage.

These advantages of B-H Insulating Cement are real advantages that result in worthwhile savings. Why not let us send you a generous free sample so that you can make your own tests? Write us now on your business letterhead.

BALDWIN-HILL COMPANY

Insulations

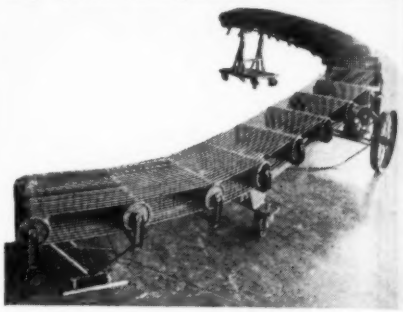
575 KLAGG AVE.
TRENTON, N. J.

Branches in:
NEW YORK • CHICAGO
KALAMAZOO

3 in. overall and the fittings are hollow so that flow may pass through them. Unit may be equipped with an alarm which is a positive device for visible or audible protection against dangerously low or high flows. This action is accomplished by means of a magnetic float extension which trips a magnetic switch to operate the alarm circuit. High and low alarm positions are adjustable over the entire range of the instrument. *Fischer & Porter Co, County Line Rd, Hatboro, Pa.*

Portable Conveyor

USE OF STEEL SPRING BELTS in Flexoveyor make the unit capable of conveying around turns and curves, going through doorways from one room to the other on different elevations, and stock piling or transferring between conveying system and pilers. No mechanical



adjustments are needed since flexible joints at 20-in. intervals permit wide range of swivel action at either receiving or delivery end. Conveyor will operate in either direction. Unit is portable and can be moved from one location to another. Head end can be raised and lowered by simple hydraulic hand-operated lift. It will operate around curves or series of curves up to a 90-deg angle. *E C Horne Machy Co, 315 E & C Bldg, Denver, Colo.*

Plastic Coating

SERVIRON, PERMANENTLY PLASTIC material applied like paint, is said to protect boiler drums, metal, wood or concrete storage tanks and water-submerged surfaces against corrosion and fungus growths. Stretches and contracts with temperature changes, eliminating danger of hairline cracks in the coating which would permit undetected corrosion under the protective surface. According to the maker, Serviron will not melt, freeze, crack or peel at temperatures from below freezing to 500-550 F. It also is said to withstand certain acids, brines and custics, and may be used to coat valves, ammonia lines and underground pipes and tanks. *Saverite Engineering Co, 1000 Clinton St, Hoboken, N. J.*

then I said to myself—

So . . . the Nazis couldn't sink her!

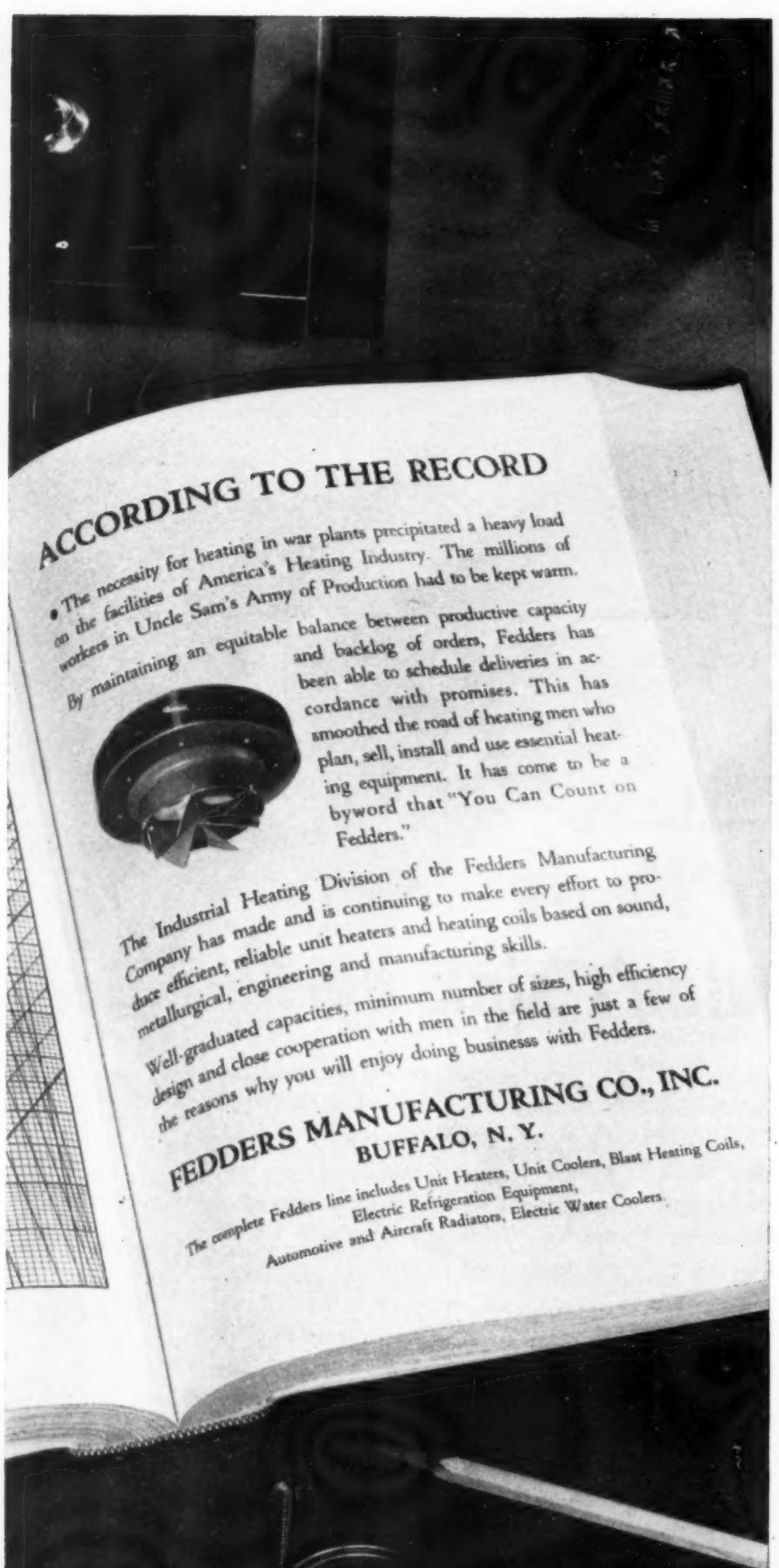
This 12,500-ton, all-welded tanker "Victoria" was torpedoed amidships. Her deck plates buckled but her bulkheads held. Then, the baffled Nazis smashed a second torpedo into her and left, confident she was finished. But those welds refused to yield—even to Nazi TNT. She made it to port and was repaired—ready for the subs again. Some ship, I say!

Some construction, you mean! This is just one of many welded ships that have refused to be licked by torpedoes. Just like our welded M-4 tanks which withstood the Nazi 88's in North Africa. Ships, tanks, planes and guns—they're all welded for strength as well as for savings in time and materials.

Better products and *lower costs*—just what I want in my business after the war. Then why shouldn't I weld my peace-time products?

You should! You MUST if you plan to survive in the face of war-developed ideas. And believe me, your ship of business will sink or float, depending on how well you can stand up against competition on WELDING ECONOMY. Why not start NOW to learn from Lincoln the latest kinks in welding thrift.

THE LINCOLN ELECTRIC COMPANY, CLEVELAND, OHIO


ACCORDING TO THE RECORD
• The necessity for heating in war plants precipitated a heavy load on the facilities of America's Heating Industry. The millions of workers in Uncle Sam's Army of Production had to be kept warm.
By maintaining an equitable balance between productive capacity and backlog of orders, Fedders has been able to schedule deliveries in accordance with promises. This has smoothed the road of heating men who plan, sell, install and use essential heating equipment. It has come to be a byword that "You Can Count on Fedders."
The Industrial Heating Division of the Fedders Manufacturing Company has made and is continuing to make every effort to produce efficient, reliable unit heaters and heating coils based on sound, metallurgical, engineering and manufacturing skills.
Well-graduated capacities, minimum number of sizes, high efficiency design and close cooperation with men in the field are just a few of the reasons why you will enjoy doing businesss with Fedders.
FEDDERS MANUFACTURING CO., INC.
BUFFALO, N. Y.
The complete Fedders line includes Unit Heaters, Unit Coolers, Blast Heating Coils, Electric Refrigeration Equipment, Automotive and Aircraft Radiators, Electric Water Coolers.

Power Lines

(*Continued from page* 130)

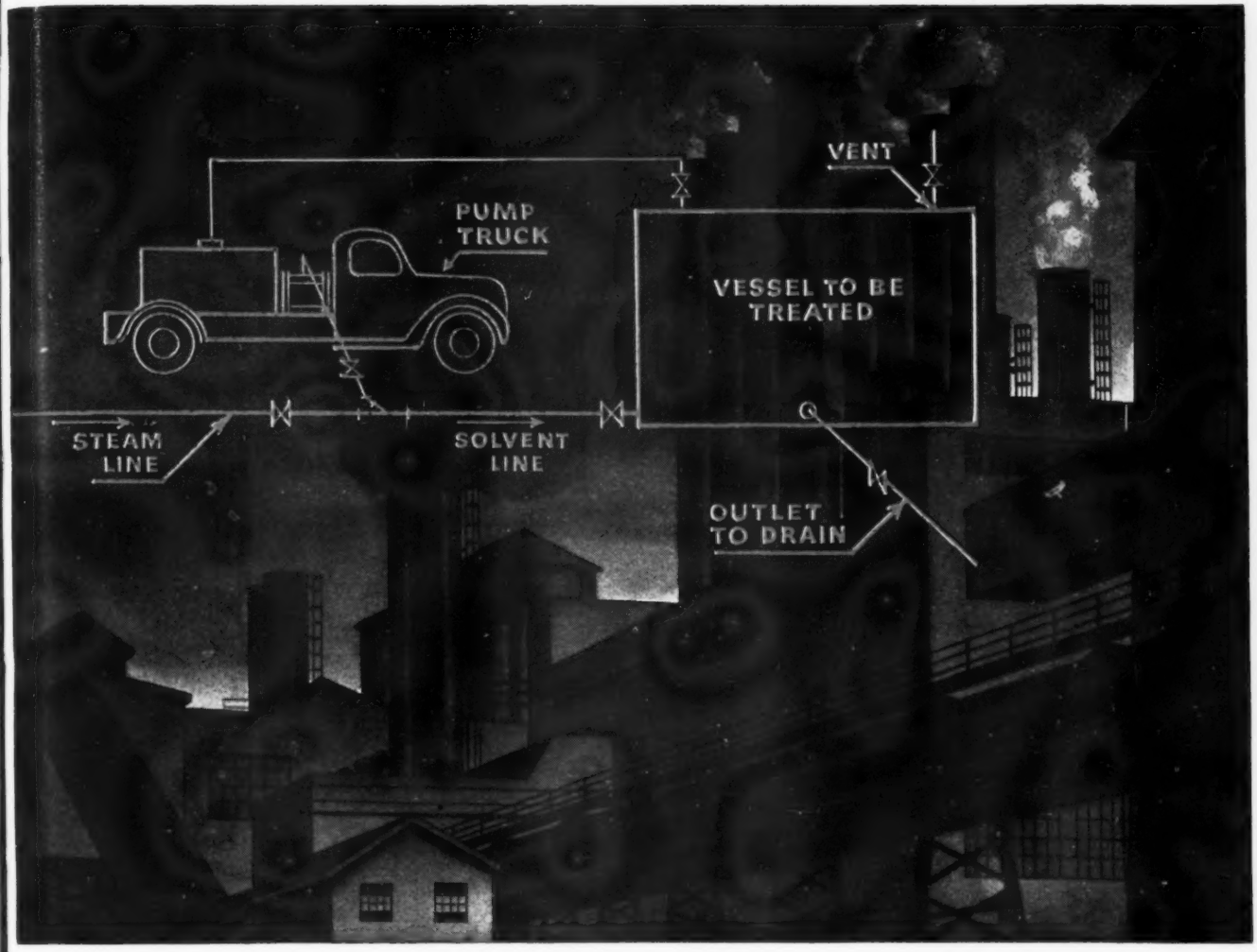
president of the Austrian Committee of the International Electrical Commission and of the Austrian Institute of Electrical Engineers.

Thomas B Davis, former plant engineer for the old Charlottesville and Albemarle, Va., Street Railway, and later for the **Virginia Public Service Commission,** died May 8 at the University of Virginia Hospital.

Word has just been received in this country of the death of **Prof A Stodola,** which occurred on Dec 25, 1942. Dr Stodola was in his 84th year. To quote briefly our English contemporary, *Engineering*: "To the younger generation of engineering designers he appeared almost a legendary link with the earliest days of high-speed rotating machinery, the mathematical study of which owes much to his originality of thought and his perseverence in scientific investigation. So much was this the case, indeed, that many engineers, on the occasion of the conferment upon him of the James Watt International Medal by the Institution of Mechanical Engineers in January, 1941, expressed surprise on learning that he was still alive...he was not merely alive, but was still engaged in original research of an impressive and practical character as was evidenced by...by the article... **'Load Test of a 4,000-kw Combustion Turbine Set;'** an article which gave little indication that its author was even then an octogenarian."

S Stanley Kent, chief engineer of the Locks & Canals Corp, Lowell, Mass., died suddenly in that city on May 16. He was a graduate of the Harvard Engineering School and for a time was connected with the **Stone & Webster Engineering Corp** at Boston.

Robert W Rollins, 79, former president of the **Worcester (Mass) Electric Light Co,** and for many years general manager of the Hartford, Conn., Electric Light Co, died at Worcester on May 19. He was born in Newbury, Vt., and in his early career was operating engineer of the generating station of the Hartford Co, at one time with the Schuyler Electric Co, Hartford, generator manufacturers, and also district engineer of the Westinghouse Co at Boston. **The Webster Street Station** of the Worcester Co was developed under his direction and production problems engaged his interest during his long connection with the power industry.



HERE'S THE HOOK-UP

FOR IMPROVED PLANT EFFICIENCY—LESS SHUT-DOWN TIME

The above diagram shows one of the typical hook-ups for Dowell Industrial Cleaning and Scale Removal treatments. After scale samples have been analyzed by chemical, X-ray, spectrographic or solubility methods, the solvents required for dissolving the water-deposited scale are transported to the vessel to be cleaned by special automotive pumping units.

Pumps are used to circulate the scale dissolving solutions, throughout the entire vessel, for a predetermined period. Accurate records—such as solvent concentration, temperature readings, pumping rates and corrosion control observations—are made throughout the treatment.

This safe, fast and economical chemical method dissolves or disintegrates water-deposited scale and sludge from *all* types of heat exchange equipment including boilers, condensers, feed water heaters, cooling jackets, water lines—all types of vessels that contain scale depositing fluids. Write for special literature.

DOWELL INCORPORATED
Kennedy Bldg., Tulsa, Oklahoma
Subsidiary of The Dow Chemical Company

Look to
DOWELL
FOR INDUSTRIAL CLEANING AND SCALE REMOVAL SERVICE

PRECISION TEMPERATURE CONTROL

FOR EFFICIENT AIRCRAFT PRODUCTION

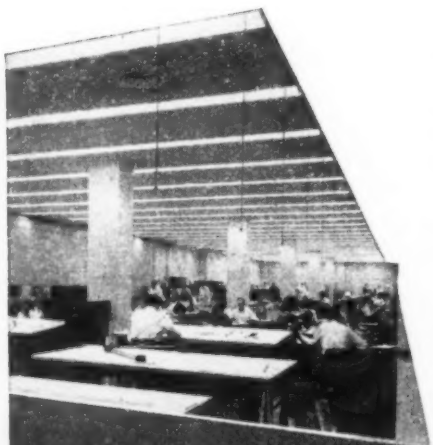
World's largest air-conditioned industrial plant . . . the Consolidated Aircraft Corporation's plant . . . somewhere in Texas. Intricate heating and air-conditioning are regulated vigilantly by Johnson Control equipment.

• • •

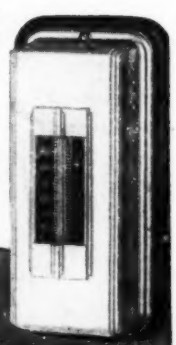
PROPER working temperatures improve morale and workmanship . . . production is stepped up . . . bombers and cargo planes roll off the assembly line, night and day, without interruption.

A central control panel, 35 feet long, containing 200 switches, gauges and instruments gives the flexibility needed in heating and air-conditioning the different buildings of this enormous plant, designed and built by The Austin Company. The load factor varies widely from zone to zone in different buildings, and even in different parts of the same building, but Johnson equipment handles it all, efficiently and simply.

Whether your problem is a bomber plant, some other industrial project, or any type of building related to the war effort, Johnson engineers are ready to serve you.



• *In addition to temperature control equipment, Johnson, alive to its wartime role, manufactures vital aircraft instruments and accessories. Beyond that, Johnson's factory machinery and assembly lines are at work on parts and sub-assemblies for a wide variety of the other implements of war.*



JOHNSON

SERVICE COMPANY • MILWAUKEE, WISCONSIN

Direct Branches in All Principal Cities

He retired from his Worcester post in 1929.

Peter C Gill, electrical transmission and distribution superintendent for the British Columbia Electric Railway Co, Vancouver, B. C., died recently after long service with the company. Mr Gill, born in Prescott, Ont., came to B. C. as a child, was educated in Victoria, graduating from McGill University in Electrical Engineering. He joined the British Columbia Electric in 1910 as an assistant in the electrical department. In 1914 he became distribution engineer as superintendent in charge of construction and maintenance of all overhead and underground power circuits throughout the company's lower mainland system in 1921. He held this position at the time of his death. He was a member of the University Club, Professional Engineers, and American Institute of Electrical Engineers.

J M Goff, 67, president and general manager of the **E M Dart Mfg Co,** Providence, R. I., died at his home on April 29. He was a native of Providence and had been with the company for 45 years.

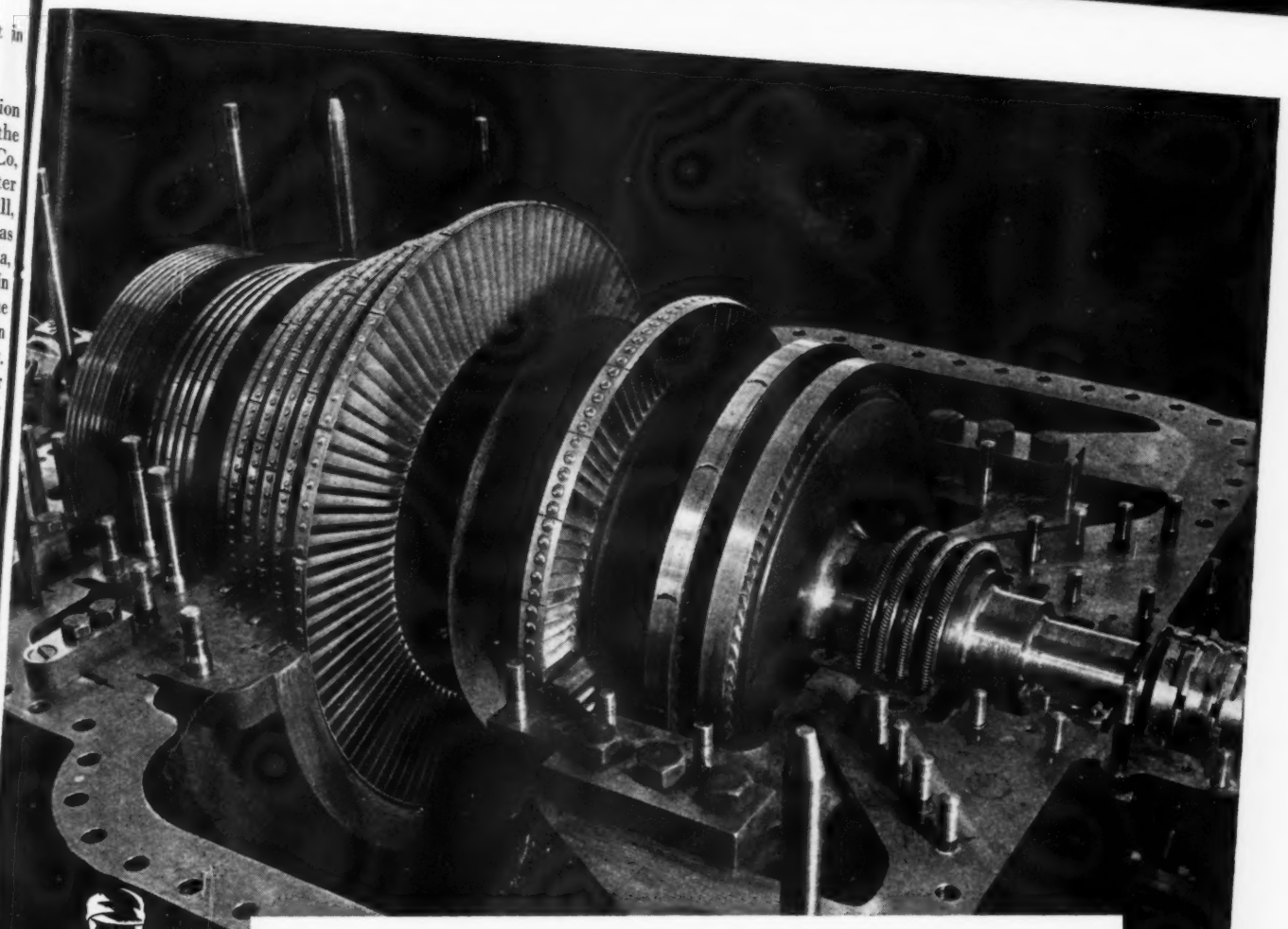
Albert L Austin, sales engineer of **Robins Conveyors** Incorporated, passed away May 2, 1943. Mr Austin joined the Mead-Morrison Mfg Co as draftsman in the late summer of 1915; when Robins took over the coal and ore handling products of the company in 1934, Mr Austin became a Robins sales engineer.

o o o

F J Healy has been appointed vice-president in charge of operations of **Sylvania Electric Products,** Inc. Mr Healy was formerly vice president in charge of the lighting division . . . **E J Campbell** has joined the staff of the **Wolverine Tube Division** of Calumet & Hecla, Detroit. Coming to Wolverine after nine years with the Detroit Edison Co, Mr Campbell will be in charge of the Electrical Dept. . . . **Thomas F Hanley,** treasurer and director of the **Dowty Equipment Corp,** has been appointed general manager of the company.

Gordon Lefebvre has been elected president and general manager of the **Cooper-Bessemer Corp.** He will succeed B B Williams, former president of Cooper-Bessemer, who will remain active in the corporation, continuing his duties as chairman of the board. . . . **Grant B Shipley** has been elected chairman of the board of directors of the **Elliott Co,** Jeanette, Pa.

Oscar B Benson, head of the storage



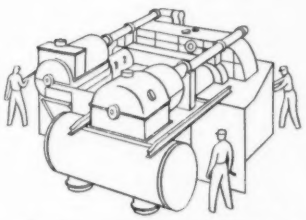
The Iron Man of Hendy...a symbol of the iron will and determination with which the thousands of men and women in the Hendy organization are working to provide "Power for the Bridge of Ships."

THE TURBINE IS THE HEART

Deep in the hulls of the big cargo ships are humming hearts of steel... bearing the Hendy name-plate. These turbines, developing thousands of horse-power, speed the guns, ammunition and supplies, on dependable schedules, to our multiple battle front.

To build these intricate power plants requires not only vast plant facilities, precise material control, precision tools and fabrication methods, but in addition, a group of highly skilled engineers, master craftsmen and production strategists.

Like the huge 2500 hp Hendy engines, which now power one-third of all Liberty ships, Hendy turbines are the heart of a vital military transport system that some day will be used to reconstruct a war-torn world.



Hendy has reduced the difficult job of building marine steam turbines and their reduction gears to a simple, straight-line production method which assures accuracy and economy with dependable delivery schedules.

Hendy has been awarded the Maritime M and the Army-Navy E...each with an extra Star for continued outstanding production.

JOSHUA HENDY IRON WORKS

ESTABLISHED 1856

SUNNYVALE • CALIFORNIA

Divisions: POMONA PUMP COMPANY
CROCKER-WHEELER ELECTRIC MFG. CO.

Manufacturing Plants: SUNNYVALE, LONG BEACH, POMONA and TORRANCE in CALIFORNIA • AMPERE, N. J. • ST. LOUIS, MO.
Branch Offices: NEW YORK • WASHINGTON • PHILADELPHIA
PITTSBURGH • CHICAGO • ST. LOUIS • SAN FRANCISCO • LOS ANGELES

Faster Adjustment

Wartime minutes count

OUTPUT demands and accuracy standards both are met by Laminum Shim quick, precision adjustments that move machines faster off the assembly line.

Shims cut to your specifications. Stock shim materials obtainable from your dealer. Write us for further information and shim application chart.

Laminated Shim Company
Incorporated
61 Union Street • Glenbrook, Conn.

2047

LAMINUM
THE SOLID SHIM THAT peels FOR ADJUSTMENT

battery division of the **Boston Edison** production department from 1920 to 1941, and since then assistant chief of electrical operations in substations, has been appointed assistant industrial relations manager. Mr. Benson entered the company's service in 1911, being attached to the then generating department. . . . **Leigh Willard,** once an **Allis-Chalmers** draftsman, was elected a company director at the annual stockholders meeting in May. Mr Willard will fill the vacancy left on the board by the death of Max W Babb. The new director is also president and director of the Interlake Iron Corp.

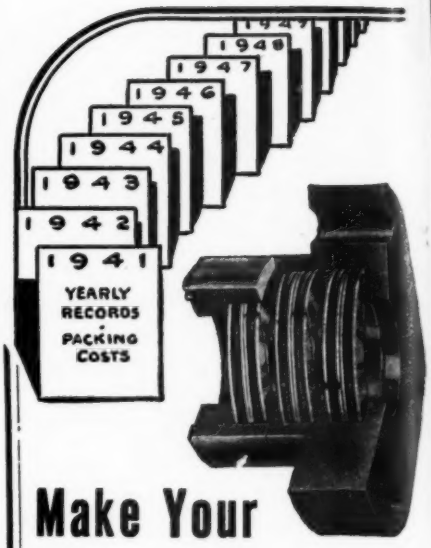
The appointment of **Walter F Pohl** as district engineer for the Southeastern area, has just been announced by **E F Drew & Co, Inc, American Colloid Division.** . . . **A E Bedell** has been appointed chief engineer of the **Graver Tank & Mfg Co, Inc,** in charge of all engineering developments covering all divisions of the company. Mr. Bedell was formerly associated with Max B Miller & Co, Inc, and for 14 years was in charge of engineering for that company.

A new library on welding, believed to be the most extensive in existence, has been established at the **Ohio State University,** according to Mr E N Manchester, university librarian. Known as the "A F Davis Welding Library," it is the gift of A F Davis, vice-president and secretary, **The Lincoln Electric Co,** Cleveland, Ohio. Mr Davis received the degree of M E in electrical engineering from the university in 1914.

Elmer R Miller, manager of the molded goods department of the Industrial Products Sales Division of the **B F Goodrich Co,** retired from active service on May 1 after 44 years with the company. . . . **John W. Haddock** has resigned from the Sullivan Machinery Co to become president of the **Farrel-Birmingham Co** of Ansonia, Conn. Mr Haddock, during his association of more than twenty years with Sullivan, has advanced progressively from an apprentice to vice-president in charge of engineering and sales.

C H Wallace has been appointed sales manager of the Tolhurst Centrifugal Division of **American Machine and Metals, Inc.** . . . **Frank M Robb** formerly of Springfield, Mass., has been named manager of the manufacturing and repair department, **Westinghouse Electric & Mfg Co,** for the Los Angeles area.

The Proceedings of the **Third Annual Water Conference** of the Engineers Society of Western Pennsylvania are



Make Your Next Packing Job L-A-S-T!

During these days of increased production, it is especially annoying and costly to experience shutdowns due to packing trouble.

There is a solution. Install France "Full-floating" Metal Packing in your engines, pumps and compressors. The result is increased efficiency. And each job lasts for years without maintenance expense. Saves money, too, in the long run.

Installation is a simple procedure. See that the rings are installed as lettered to correspond with similar letters on the case. As simple as A-B-C.

ORIGINAL FRANCE
Sold on approval
Satisfaction Guaranteed

Write for details and Catalog M-7. Make your next packing job L-A-S-T!

THE FRANCE PACKING COMPANY
Tacony Philadelphia Penna.
Mid-Continent Representative:
Mr. J. M. FULLER, 3725 West 7th St.
FORT WORTH, TEXAS

Original FRANCE METAL PACKING

F&E

THIS EMBLEM ON A STOKER PROMISES

- *Dependable,*
- *Efficient,*
- *Economical*

PERFORMANCE

The "F&E" name plate on an "F&E" Underfeed Stoker signifies the capability of that stoker to carry on a 25-year reputation for outstanding stoker performance. For here at "F&E" we are justly proud of the performance records "F&E" Stokers have made in hundreds upon hundreds of all types of power plants. They are the result of sound stoker design and engineering, precision workmanship, quality materials and capable engineering.

To heating and power engineers, the "F&E" name plate has become a symbol that represents satisfaction of their most exacting specifications.

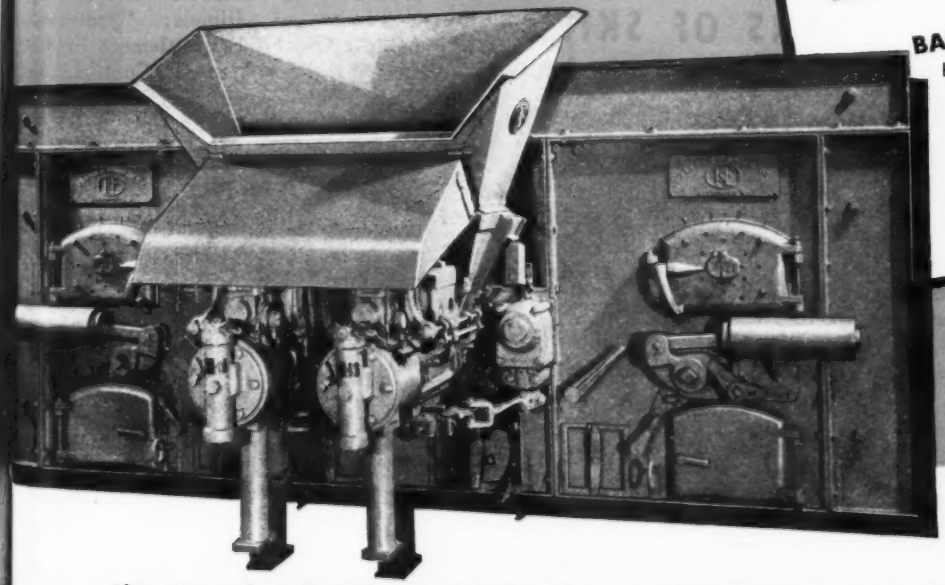
THE FLYNN & EMRICH CO.

Established 1842

BALTIMORE • MARYLAND

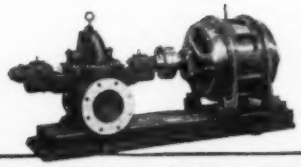
Representatives in Principal Cities

"F&E" Stokers are available in Anthracite or Bituminous Types, with Electro-Hydraulic or Steam Drive . . . . for heating or power boilers requiring 1,000 to 40,000 lbs. of steam per hour.



Illustrated is the "F&E" Series 70 Heavy Duty, Double Retort, Underfeed Stoker with Electro Hydraulic Drive, Moving Grates and Power Ash Dumps.

Literature that describes in detail such outstanding features as the "F&E" Electro-Hydraulic Drive, the "F&E" patented Interval Timer Governor and the Ram Safety Feature is available upon request.



Fighters on the WARREN PUMP Production Front . . No. 4 of a Series

"POP" BRINGS 30 YEARS OF SKILL TO EVERY JOB HE DOES

Chester B. Hathaway — ("Pop", to *us*) has had 30 years of service with Warren Steam Pump Company, Inc.

"Pop" is a vertical turret lathe operator of such skill that he can speed up with the very best of them . . . and is an artist at work which calls for close tolerances.

It is the experience, skill and conscientious effort of "Pop" and his fellow Warren employees that make it possible for Warren Pumps to be "built to fit the job," without any compromise in quality. And it is the pride that these skilled men take in Warren Pumps that enable Warren equipment to perform, so faithfully, their important job in helping to win the war.

WARREN PUMPS

WARREN STEAM PUMP COMPANY, INC.
WARREN, MASSACHUSETTS

CURRENT ARMY-NAVY AWARDS

George D Roper Corp. Award presented April 23.

Barberton Works, The Babcock & Wilcox Co. Two-star award presented April 2. *Maritime Renewal Award presented April 30.*

Sterling Engine Co. Award presented April 30, 1943.

The Foxboro Co. Award presented April 28, 1943.

Hammond Brass Works. Award presented April 27, 1943.

Ampco Metal, Inc. Award presented May 16, 1943.

Stewart-Warner Corp. One-Star award presented May 26, 1943.

Nordberg Mfg Co. *Maritime "M" Award presented May 17, 1943.*

Climax Engineering Co. Army-Navy Award presented May 7. 1943.

Foster-Wheeler Corp. Two-Star award presented to Carteret plant, May 14.

Steam Turbine Division, Worthington Pump & Machinery Corp. Award presented March 12, 1943.

Pennsylvania Gulf Mfg Co. Award presented recently.

Alloy Steel Products Co. Award presented June 17, 1943.

---

now available for distribution. The Proceedings contain such papers as "Solubility of Salts in Steam at High Pressures," by **F G Straub,** research professor of chemical engineering, University of Illinois; "Protection Against Caustic Embrittlement by Coordinated Phosphate pH Control." by **Dr S F Whirl,** chief chemist, and **T E Purcell,** general superintendent of power stations, Duquesne Light Co; "Water Treating Equipment for War Industries," by **S B Applebaum,** vice-president, the Permutit Co, New York, and many others. Write to **H M Olson,** Chairman, Water Conference, **Engineers' Society of Western Pennsylvania,** Hotel William Penn, Pittsburgh, for a copy, priced at $3.

Ricewood Corp, representative for Cardox Fire Extinguishing Systems in 11 western states, has become a subsidiary of the **Cardox Corp,** and will be known as Cardox Western, Inc.

N E Funk, vice-president in charge of engineering of the **Philadelphia**

ONE OF A SERIES OF SUGGESTIONS TO AID PRODUCTION

ONE OF A SERIES OF SUGGESTIONS TO AID PRODUCTION

HOW TO SOLVE

Operating Problems with *Correct Lubrication*

Keep this "Chain Gang" Tough!

MODERN CHAIN DRIVES are playing an important part in maintaining wartime production. They have been designed to take heavy loads at high speeds. They'll do their job week after week if given proper service and lubrication.

First, keep your chain drive in proper mechanical condition and correct adjustment, then the next step is... **USE GARGOYLE VACUOLINE OIL** for the type of lubrication shown above. This oil will penetrate the close clearances between the pins and bushings. It will provide a dependable, protective oil film... assure minimum maintenance...maximum oil life. There's the type lubrication you're looking for.

GARGOYLE Lubricants

SOCONY-VACUUM OIL COMPANY, INC. — Standard Oil of N. Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. White Eagle Div. • Wadhams Div. • Magnolia Petroleum Company • General Petroleum Corporation of California

CALL IN SOCONY-VACUUM

How to obtain ALL-OUT savings, better performance, from your flush valves

THESE are days when the performance of flush valves should be checked carefully. For example, by making sure that every flush valve is properly adjusted, tremendous *extra* savings of water can often be obtained. (Such savings contribute to fuel and power savings; help the war effort.) Moreover, proper maintenance can often eliminate the need for repair parts that are made of critical materials.

To meet the need for more information on the whole subject of flush valve maintenance, the Imperial Brass Mfg. Company has published a 16 page manual—"Keep 'Em Flushing." It shows how a flush valve operates—how to get maximum water savings from flush valves—how to keep maintenance time at a minimum. Includes a helpful "Trouble-Shooter" Chart and other practical data.

Write for your copy

THE IMPERIAL BRASS MFG. CO.
1239 West Harrison St., Chicago, Illinois

Watrous Flush Valves

Electric Co, was awarded a degree of doctor of engineering by Lehigh University at its 75th commencement May 24. Mr Funk, a graduate of Lehigh in the Class of 1905, has been associated with the Philadelphia Electric Co since 1907.

V H Peterson, for the past two years vice-president of the **Elliott Co,** has been appointed assistant to the president of the **Baldwin Locomotive Works,** effective June 1, 1943. . . . **R M Cherry** has been appointed assistant manager of the **General Electric** Industrial Heating Division. Mr Cherry becames associated with General Electric in 1919. . . . **Hugh E Anderson,** of the sales department of **Honan-Crane Corp,** has been appointed general sales manager for the corporation. Previous to his association with Honan-Crane, Mr Anderson was associated with the Packard Motor Co, Detroit.

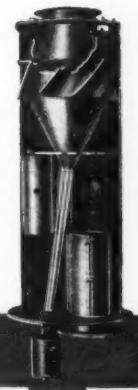
At a meeting of the directors of **Handy & Harman,** New York, the following officers were re-elected: **C W Handy,** chairman; **G H Niemeyer,** president; **R H Leach,** vice-president; **H W Boynton,** treasurer; **H W Spaulding,** secretary. **Judson C Travis,** formerly assistant to the president, and recently elected to the board of directors, to replace **H H DeLoss,** deceased, was elected vice-president in charge of sales.

A new **all-color sound movie,** "The Inside of Atomic-Hydrogen Arc Welding," has been announced by the **General Electric Co,** to help in the training of men and women welding operators using this process in war industries. **The movie is in two parts** and is available to public, private and industrial welding schools and other groups. The new film follows the pattern of "The Inside of Arc Welding" films released by the company last year.

Ownership of **McAlear Mfg Co,** Chicago, was acquired by the interests controlling **Climax Engineering Co,** recently. **Edward F Deacon,** Climax president, will also be president and general manager of the McAlear Co.

As a helpful step in instructing users of the oxyacetylene welding and cutting process how to prolong the life of their equipment, the International Acetylene Association has prepared a convenient 20-page pocket-size booklet entitled, **"Handbook for the Welding and Cutting Operator."** It contains a list of concise do's and dont's for the man who wields the blowpipe and a wealth of other helpful information and suggestions on the care and maintenance of blowpipes, regulators and welding and cutting accessories. Copies in

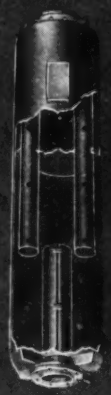
Award for silence



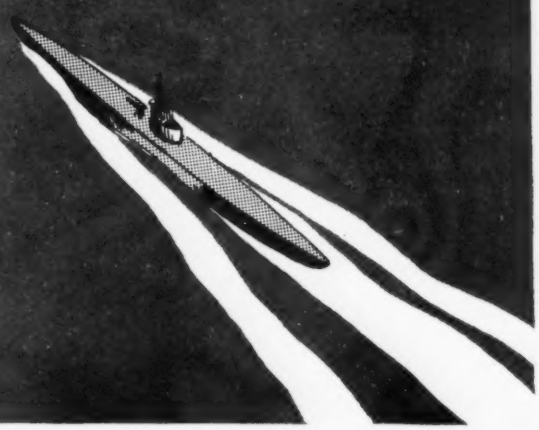
MAXIM

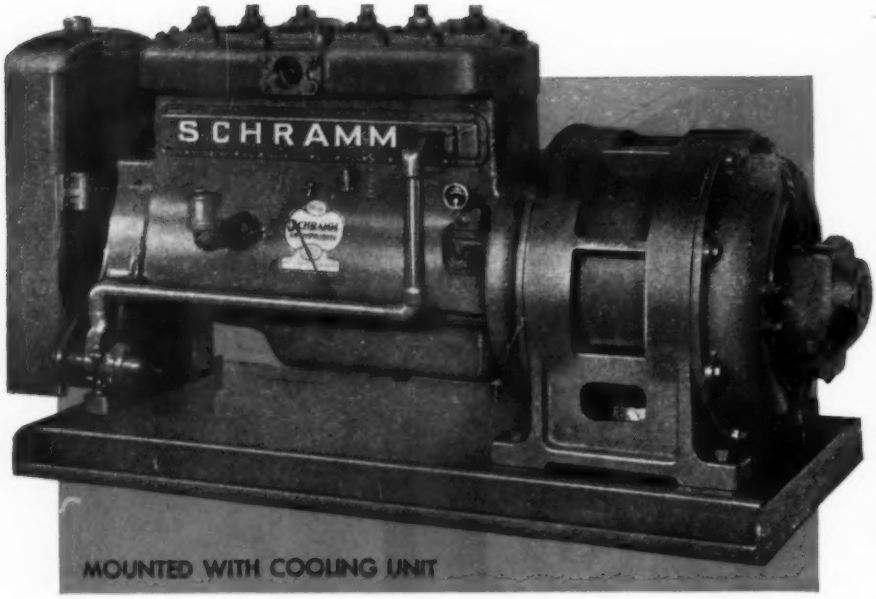
Silence, on the face of it, may seem a strange weapon of war . . . yet every day and every night at sea our ships "come through" because their position is not detected. For many this "positive protection" is due to Maxim Silencers which deaden engine noise to a whisper and trap all telltale sparks and embers.

For turning out this vital silencing equipment in ever increasing quantities, Maxim employees have earned the Army-Navy Production Award. Proud of this recognition, they are determined to better the record that earned it for them. The Maxim Silencer Co., 99 Homestead Ave., Hartford, Conn.



Maxim Waste Heat Units combine silencing, spark arresting and the utilization of waste exhaust heat to produce steam or hot water. Write for Bulletin WH-100.





JUST LAY IT ON THE FLOOR

and hook up to current and air lines . . . . . .

In spite of the fact that the SCHRAMM Compressor unit shown above comprises motor, compressor and radiator, it actually is a "one-piece job". All are assembled rigidly and in perfect alignment on a substantial steel base which can serve as a vibrationless foundation. No belts, pulleys, flywheels or water connections are necessary.

If it's a Schramm you can pack a 600 cu. ft. per min. job into a space measuring only 90 ins. x 37 ins. Schramm's vertical, in-line design makes it a neat, compact package, for heavy and continuous service . . . Motor controls for the required starting current and torque can be furnished as a part of the unit or for remote installation . . . Sizes range from 50 to 600 cu. ft. displacement at 100 lbs. pressure.

Schramm Water-Cooled Air Compressors can be depended on for outstanding performance and satisfactory cooling under all temperature conditions, summer or winter, because water jackets completely surrounding cylinders and heads assure uniform cooling.

THE DATA YOU'LL WANT before deciding on any compressor can be found in our Catalog 42-S. Your request will bring a copy by return mail. Write today.

SCHRAMM INC.

THE COMPRESSOR PEOPLE
WEST CHESTER
PENNSYLVANIA

reasonable quantities may be obtained without charge by writing to the **International Acetylene Association,** 30 East 42nd St, New York, N. Y.

An unsuspected threat to production confronts industry in the prospect of a shortage of all wood pulp products, with special emphasis on commercial papers, according to an article in *Factory*. Business and industrial publications have reduced their use of paper by at least 10 percent. Trimmed sizes have been lessened and a stock of much lighter weight is being used. These reductions proposed by the publishers themselves, are being accurately checked by a duly constituted agency. **Even without reduction,** the total consumption of paper by the business publications was a remarkably small part of all paper consumption, less than four hundredths of 1 percent. Here are five guiding questions which every management should ask about every piece of written or printed matter which it orders and uses:

1. Is it necessary?
2. Can lighter paper be used?
3. Can a smaller size be used?
4. Can the number of printed pieces be reduced by pruning distribution lists?
5. Is an excessive inventory of paper on hand (Sixty days is today's allowable margin—six months the peacetime average).

The War Production Board officials urge every top management to make a competent operating executive responsible for the application of these principles in each plant. Here is a brief checklist for further guidance of the papersaver:

Review all printed forms periodically for essentiality, consolidation, elimination of waste space, standardization of sizes, weights, color, grade, elimination of color where possible.

Use small type sizes and margins.

Cut the weight of paper stocks.

Condense letters and memoranda by (a) keeping margins as narrow as possible; (b) sticking to single-space forms; (c) using reverse side of incoming letters as first carbon copy of replies; (d) using reverse side of second sheets for carbon copies; (e) using both sides of all mimeographed sheets.

Make scratch pads from stocks of obsolete letterheads, memorandum forms, and other unused inventory.

The above list could be a little bit more elaborate, but any who adopt these few simple practices will be covering nine-tenths of its opportunities to conserve a very important commodity at a very important time.

Iron & Steel Products, Inc., an-

THE magic of Electronics will be used in every plant to create new and useful products—to multiply production—to effect economies—to do heretofore impossible tasks of measurement and control of industrial processes.

Already, M-H/Brown engineers have pioneered and developed new Electronic instruments which will take the word "impossible" from the industrial lexicon.

In this hour of history M-H/Brown engineers fittingly symbolize our faith in the future — that Electronic instrumentation (now at war) will blaze new trails in the manufacture of peacetime products. The Brown Instrument Company, 4490 Wayne Avenue, Philadelphia, Pennsylvania, a division of Minneapolis-Honeywell Regulator Company, Minneapolis, Minnesota. Offices in all principal cities. 119 Peter Street, Toronto, Canada—Wadsworth Road, Perivale, Middlesex, England—Nybrokajen 7, Stockholm, Sweden.

Instruments by **BROWN** *and Controls by*

MINNEAPOLIS-HONEYWELL

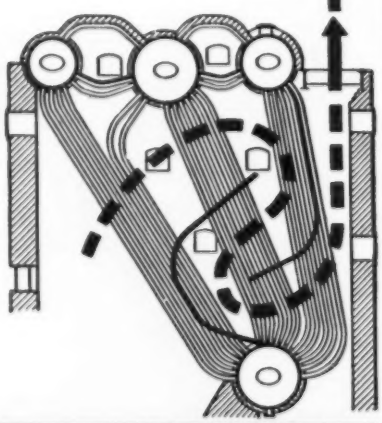
Enco

Extra Power Quickly

...and easily... with these Fuel-Saving Baffles

- Provide cross-flow of gases over tubes for maximum heat-transfer
- Tapered gas passes and curved surfaces streamline the gas flow and maintain gas velocity for efficient heat-extraction
- Draft losses materially reduced by elimination of eddy currents, bottlenecks and dead gas pockets
- Less steam used in cleaning because soot blowers are used less often, and more effectively
- Applicable to any design of water-tube boiler, fired by any fuel
- Each installation is designed on the basis of 25 years experience in this specialized branch of engineering
- Installed by skilled mechanics

Ask for bulletin BW 40 giving valuable data on modern baffle-wall constructions — free



THE ENGINEER CO.
Enco 75 West St. New York, N.Y.

nounce the following changes in management, effective May 26; **Frank Parker**, chairman; **Albert G Bladholm**, president; **John F Parker**, vice-president and treasurer; **William J Parker**, vice-president and secretary; **Royal J Casper**, assistant secretary.

Executives of **Bridgeport Brass Sales Dept** received promotions recently. **Austin R Zender** has been named general sales director, and **A Dean Merwin** has been named director of fabricating sales. **George H Baldwin** will continue as general sales manager of the Mill Products Division.

Swan-Finch Oil Corp, RCA Bldg, West, New York, has published a new booklet, "90 Years of Industrial Pioneering," showing the progress and development of lubricating oils and how these products are helping to win the war. Copies will be sent upon request on a firm letterhead.

Don G Mitchell, vice-president in charge of sales of Sylvania Electric Products, Inc, announced that the company has opened a **new sales office** in the Lincoln Liberty Building at Broad and Chestnut Sts, Philadelphia, Pa.

A fourth generator has gone into operation at the Parker Dam power plant in Arizona-California, bringing this Colorado River development to its full capacity of more than **115,000 kw**, according to a release from Secretary of the Interior, Harold L Ickes. In the release Mr Ickes says: "Because of the emergency, the Parker power plant was brought to full capacity about ten years ahead of schedule. Original plans did not contemplate adding the fourth and final generator until 1950 or later." Completion of the Parker installation brings the rated capacity of the Bureau of Reclamation to 30 power plants on 18 projects in 11 Western states to **more than 1,834,000 kw.**

W H Aubrey, vice-president of the Frick Co, Inc., was elected president of the **Air Conditioning and Refrigerating Machinery Association, Inc**, at its annual meeting. Other officers are **J P Rainbault**, General Electric Co, first vice-president; **D W Russell**, Airtemp Division, Chrysler Corp, second vice-president; and **P A McKittrick**, Parks-Cramer Co, treasurer.

E T Murphy, vice-president, Carrier Corp, was elected to the chairmanship of the ACRMA Board of Directors. . . . The appointment of **Robert R Zisette** as general sales manager of **SKF Industries, Inc**, Philadelphia, has just been announced.

The "HOWS" and "WHYS" of GASKET ENGINEERING

... from the Research Laboratory of "Gasket Headquarters"

Do you know all the factors bearing upon the selection of the proper gasket for a particular service?

Enlightening information is contained in the current issue of "The Gasket"—the first of a series of technical bulletins to be issued by the modern Research Laboratory of the Goetze Gasket and Packing Company, oldest and largest manufacturers of industrial gaskets in America.

We will be glad to send these bulletins to you regularly, if you write on company letterhead, giving your position.

GOETZE GASKET & PACKING, CO., Inc.
10 Allen Avenue, New Brunswick, N. J.

Goetze for GASKETS

ARMY JUMPERS NEED RUBBER BUMPERS

. . . and rubber is still "hard to get!"

PARATROOPERS are trained to land on their feet—but that isn't always possible! So, to lessen the danger of rough landings, our chutists are equipped with bumpers—special shock absorbing rubber back and seat cushions!

So numerous and so varied are the needs for rubber in combat zones and on production fronts, there can be no relaxing of the rubber conservation effort until supply catches up with demand.

If you use V-Belts, be thrifty and you'll be patriotic. Get the utmost life out of every V-Belt in your plant. Forestall premature replacement by following the simple rules in "23 WAYS TO CONSERVE THE LIFE OF YOUR MULTIPLE V-BELT DRIVES." Prepared by the Engineering Research Bureau of the Association—this valuable war time primer on V-Belt care will save money for you and rubber for your country.

Send for this free Association Book today.

The use of this emblem by an association member in connection with Multiple V-Belt Drives is your assurance of mechanical excellence . . . the result of cooperative engineering, research and experience.

MULTIPLE V-BELT DRIVE ASSOCIATION
140 SOUTH DEARBORN ST., CHICAGO

Write for this FREE Association Book Today!

Ⓞ Round packing coated by pulling thru cupped hand holding No. 1 Graphite-in-oil.

Lift

MACHINE and MONEY-SAVING IDEAS From DIXON'S New KNOW-HOW CONTAINERS

A wealth of profitable graphite applications is illustrated and described—on the containers and in the novel KNOW-HOW Use-Folder attached to each container. Here's a veritable reservoir of ideas—machine, time and money savers such as have saved millions of dollars for users over the years.

Doubtless there are more than a dozen ways your plant can profit by the use of graphite. **It out-lubricates plain oils and greases in applications of endless variety.** Use DIXON'S Graphites dry, or in oils and greases. If you prefer, use DIXON'S ready-to-use Graphited Lubricants for **any friction-fighting service.** Remember too, there's nothing as good as graphite for packings and coating pipe joints—threaded, gasketed, flanged.

Get DIXON'S Graphites in the new KNOW-HOW containers from your usual supplier—or write us for printed C69.

THE NEW KNOW-HOW PACKAGE IS NOW AVAILABLE ONLY IN THE FOLLOWING SIZES

5 & 10 lb. Ticonderoga No. 1 (Large Flakes)
5 & 10 lb. Ticonderoga No. 2 (Medium Powdered Flakes)
5 lb. No. 635 (Finely Powdered Flakes)

All other size containers of these Graphites including MICROFYNE (extra finely powdered flakes), are still being packed in the previous style packages, which will be changed as soon as new containers are obtainable.

JOSEPH DIXON CRUCIBLE COMPANY, JERSEY CITY, N. J.

Pipe Joint Compound • Graphite Seal • Graphited Oils • Cup and Pressure Gun Grease
Gear Lubricants • Waterproof Graphited Grease • Auto-Marine Grease • Graph-Air Guns
Lathe Center Graphite Lubricant • • Belt Dressing (Contains no Graphite)

4002

Publication of a new **revised list of approved fire protective equipment,** with special notes regarding the availability of particular devices under wartime scarcity, has just been announced by the **Factory Mutual Laboratories** of Boston. This is the 56th edition of the approved list, which is issued annually and is based on rigid laboratory tests on the observation of devices in actual use in manufacturing plants.

Bantam Bearings Corp, South Bend, Ind., a subsidiary of the **Torrington Co** of Torrington, Conn., for the past eight years, has been merged with its parent company and will henceforth be known as the **Torrington Co, Bantam Bearings Division.** The Bantam Division will retain its present personnel and continue its operations from the South Bend headquarters . . . **Robins Conveying Belt Co,** Passaic, N. J., announces that it is shortening its name to **Robins Conveyors Incorporated.** Thomas Matchett, president of the corporation, has stated that no change of management, personnel or corporate structure is involved in this change, which is one of name only . . . **Tube Turns, Inc,** Louisville, Ky., is publishing a series of two-page advertisements to the marine industry on the **use of welded piping in shipbuilding** and ship repair. Each takes a typical section of ship piping and shows: (1) how it has been done in the past, and (2) how it is done with welding fittings.

A new educational booklet entitled **"Maintenance of First Aid Fire-Fighting Equipment"** is being distributed by **American-LaFrance-Foamite Corp,** Elmira, N. Y. The booklet is divided into six sections: (1) Vaporizing Liquid, (2) Soda Acid, (3) Foam, (4) Anti-Freeze, (5) Carbon-Dioxide extinguishers, and (6) up-to-date charts giving complete data in condensed form as to extinguisher and engine characteristics, methods of operation, etc.

To save zinc for essential war uses, Western Electric has developed a lead coating process for pole line hardware and other items normally hot-dip galvanized. **The new method,** according to an announcement by Mr W Yonkman, requires an oil-free surface, pickling in sulphuric and hydrochloric acids, fluxing with zinc ammonium chloride, and dipping in a 700-F lead bath. No changes in equipment are required to convert a hot galvanizing unit to a lead-dipping unit. Details of the process, **offered free of patent restrictions,** can be obtained from C L **Stong, Western Electric Co,** 195 Broadway, New York, N. Y.

The First Line of Defense

No matter how badly the steel mills need scrap, a turbine or boiler will aid the war effort more by staying on the job than by going on the scrap pile.

Inactive equipment . . . equipment nearing condemnation . . . often can be made to serve you for many more months and years when protected — the quick, easy, low-cost way — with APEXIOR. And new equipment can be preserved at peak condition by this essential maintenance and operating material.

The Paint Takes the Wear

Hundreds of industrial power plants, utilities, railroads and marine operators have been using APEXIOR to lengthen the life of boiler or turbine metal. Applied with a hand brush or power-coater, APEXIOR seals up the pores and joints and provides a long-lasting, corrosion-resistant, scale-resistant covering for the metal. The APEXIOR takes the wear, not the metal — and one application lasts 2 to 3 years or more. It is easily renewed.

Painting boiler metal with APEXIOR is recommended by boiler insurance companies. And many manufacturers of turbines coat shafts, rotor bodies, and frequently interiors of casings with APEXIOR before shipping to customers.

APEXIOR is the safe, sure answer to lack of new equipment — the solution to your problem of getting more out of your present equipment. APEXIORIZE — you'll save valuable metal — and in the case of boilers, you'll lengthen periods between cleaning and make cleaning easier (with a wire brush).

Users like these have applied APEXIOR for years. It will help YOU get more service from irreplaceable equipment.

U. S. Army
U. S. Navy
U. S. Maritime Commission
U. S. Coast Guard
U. S. Bureau of Yards & Docks
U. S. Marine Corps
Cunard White Star, Ltd.
New York Central Railroad
Chicago & Northwestern Railroad
Georgia Power Co.
Duke Power Co.
Narragansett Electric Co.
Commonwealth Edison Co.

•

Ease of Applying APEXIOR Explained — Cleaning Simplified

Write, today, for Bulletin 1290 (Industrial) or 1305 (Marine) telling how to get peak production with peak protection.

APEXIOR

A Peacetime Plus ★ ★ ★ A Wartime Must

RECOMMENDED BY ALL U. S. AND CANADIAN BOILER INSURANCE COMPANIES

The **DAMPNEY COMPANY**
of America
protective coatings for
STATIONARY BOILERS, LOCOMOTIVES AND STEAMSHIPS

THE DAMPNEY COMPANY OF AMERICA
Hyde Park, Mass.

Please send me free Bulletin 1290 (industrial).....
Bulletin 1305 (marine).....

Name.....

Company.....

Address.....

Main Office: **HYDE PARK • BOSTON • MASS.** • *Branch Offices:* **ATLANTA • CHICAGO • NEW YORK • DETROIT • PHILADELPHIA**

Engineering Sales Representatives — Pittsburgh, Cincinnati, New Orleans, San Francisco, Los Angeles, Portland, Seattle, Phoenix, Denver, Salt Lake City, Dallas, Houston, Vancouver, B. C., Montreal, P. Q., Havana, Cuba, Manila, P. I., Honolulu, T. H., Marine Dept., 114 Liberty Street, New York, N. Y.

Cast Your Own Special Refractory Shapes

WITH LACLEDE HEARTHMIX OR SUPER CASTABLE • • • the *Original* Mix and Pour Castable Refractories

Why wait for special refractory shapes when you can keep production rolling by casting them on the job with Laclede Hearthmix (2700° F.) or Laclede Super Castable (2900° F.)? Why spend extra time and money cutting all kinds of special shapes to fit doors, burner rings, baffles, burner blocks, ports, special skews, etc., when you can make them quickly and easily — right on the job — and often have them ready within 24 hours?

Hearthmix and Super Castable are the original mix and pour castable refractories which set at normal room temperature. They are non-shrinking and are not affected by steam or moisture. They will not crack or crumble under alternate heating and cooling periods and do not deteriorate during intervals of non-use.

When you need an insulating refractory castable, use Laclede Pore-Lite, a light weight insulating castable that withstands temperatures up to 2500° F. in direct contact with flame. Approximately 4½″ of Pore-Lite is equivalent to 15″ of first quality fire brick or 7½″ of heavy weight castable.

It isn't necessary to take a chance on holding up production. Keep these castables on hand all the time for those unexpected jobs. Your local dealer or agent will be glad to furnish them. ***Get his name from your local telephone directory, or write direct.***

LACLEDE ENGINEERING SERVICE

When you have a problem involving refractories, call in a Laclede-Christy engineer. Because Laclede-Christy offers a *complete* line of refractories, he will give you an unbiased recommendation — the *right* recommendation for your job. Complete blueprints and estimates will be furnished without cost or obligation.

LACLEDE-CHRISTY FOUNDED 1844 ST. LOUIS, U.S.A.

LACLEDE-CHRISTY
CLAY PRODUCTS COMPANY

Ambassador Bldg., St. Louis, Missouri

World's Largest and Most Diversified Line of High Temperature Refractory Specialties

FAVORITE
Reversible
RATCHET WRENCH

THE ONLY WRENCH WITH ALL THESE FEATURES . .

- Each head fits two different sizes of nuts
- Positive, instantly reversible ratchet action
- Can be used over long studs
- Does not chew nuts
- Operates in narrow spaces
- Tightens nuts quicker
- Cannot slip off nuts

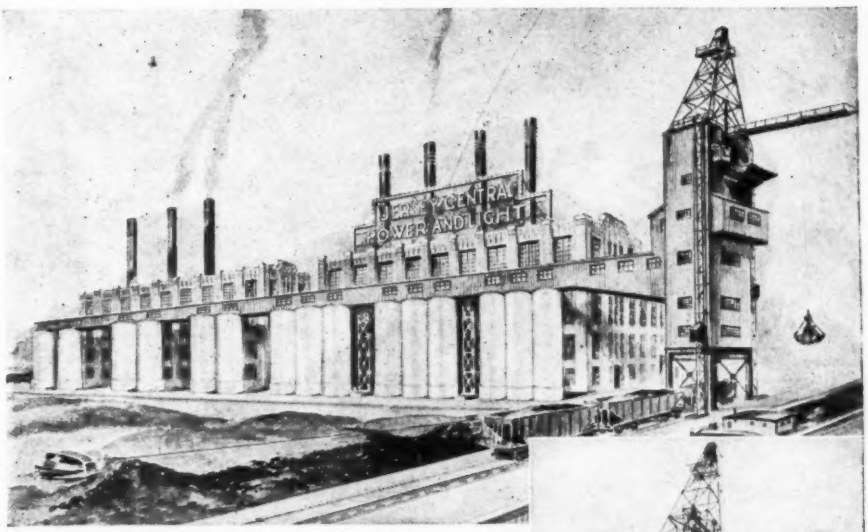
Three sizes of handles . . . each handle takes five different heads . . . each head fits two different size nuts. Write for circular and prices. Carried by leading mill supply houses.

PROMPT SHIPMENT assured by large manufacturing facilities. Made by the makers of PALMETTO and other self-lubricating packing.

GREENE, TWEED & CO.
Bronx Blvd. at 238 St., New York 66, N.Y.

CONCRETE BINS AND TANKS

A SPECIALIZED DIVISION OF THE ENGINEERING AND CONSTRUCTION FIELD



A large storage project NICHOLSON designed and built for a large public utility plant. Total storage including bins is about 25,000 tons of coal.

THE PROBLEMS involved in the design and construction of concrete storage bins and tanks have their own characteristic angles. They are unlike those in any other branch of the construction field.

NICHOLSON BINS & TANKS, as designed and built today, have back of them 30 years of experience in specialized storage construction and handling equipment for all granular and liquid materials.

Let us serve you in planning the preliminaries of your storage projects regardless of type or size.

BULK STORAGE · COAL-GRAIN-LIQUIDS STORAGE · HANDLING EQUIPMENT
CONSTRUCTION · CEMENT-OIL-CHEMICALS

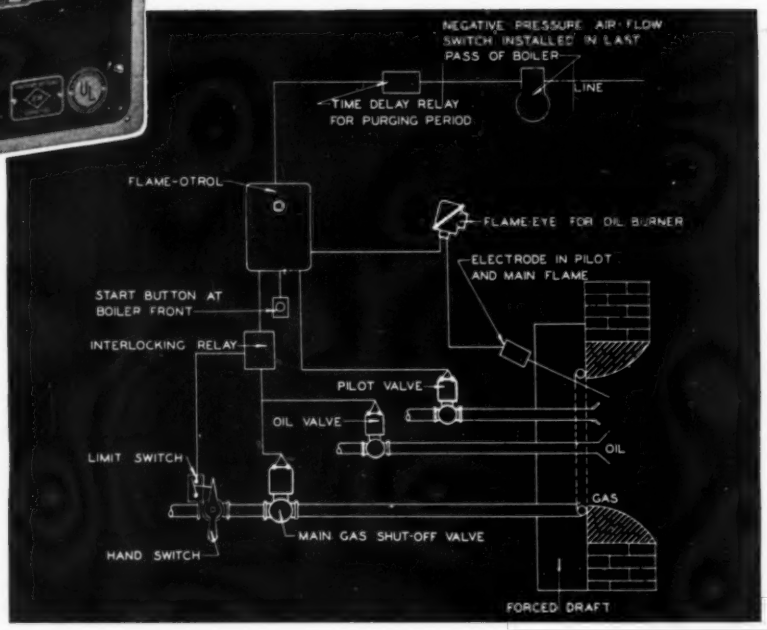
THE NICHOLSON CO.

TEN ROCKEFELLER PLAZA, NEW YORK, N. Y.

Wheelco FLAME-OTROL COMBUSTION SAFEGUARD

as applied to combination GAS and OIL Burners

Approved by Underwriters' Laboratories and Associated Factory Mutual Laboratories



Combination gas and oil burner protection by Wheelco Flame-otrols include complete purging cycle, safety shut-off features and pilot lights of sufficient size to insure main flame stability.

The Electronic Combustion safety device (a Wheelco pioneered electronic achievement) eliminates explosion hazards by preventing fuel and explosive product accumulation in the combustion chamber. Fuel, to the burner, is shut off instantly upon flame failure, or should any condition develop within the instrument itself, which might interfere with its operation. It is also a definite protection against carelessness and negligence of inexperienced operators. The Wheelco Flame-otrol operates with equal efficiency on gas, oil, powdered coal, or any combination of these fuels. Flame-otrols are available with automatic or manual ignition, time delay for purging, or other desirable sequence.

Request Bulletin L-2 for complete information on the Wheelco Flame-otrol.

Wheelco Instruments Co.

863 W. HARRISON STREET • • • CHICAGO, ILLINOIS

Originator of "Electronic Principle" Temperature Controls

For V-DAY BUILDING

BENEFIT BY CONNERY V-STIFFENED NON-BUCKLING LEAKPROOF BREECHINGS . . . .

We take pardonable pride in the fact that 100% of Connery output is going to war production projects. And we feel certain that the many plants using (and planning to use) Connery's Improved Expansion Stiffened Construction for stacks, breechings, ducts, etc., won't mind if we give our best to "our first customer," Uncle Sam.

As government priority construction slackens, however, we will be in a position to offer old and new customers specific help on their problems of power plant construction.

STACKS • BREECHINGS • UPTAKES • HOPPERS • AIR DUCTS

RECENT INSTALLATIONS

NEW HAMPSHIRE GAS & ELECTRIC CO.	PORTSMOUTH, N.H.
UNITED ILLUMINATING CO.	BRIDGEPORT, CONN.
ROCHESTER GAS AND ELECTRIC CO.	ROCHESTER, N. Y.
INDIANAPOLIS POWER & LIGHT CO.	INDIANAPOLIS, IND.
CONSOLIDATED GAS ELEC. & LIGHT PR.CO.	BALTIMORE, MD.
VIRGINIA PUBLIC SERVICE CO.	ALEXANDRIA, VA.
U. S. NAVAL TRAINING STATION	GREAT LAKES, ILL.
HENRY DISSTON SONS	PHILADELPHIA, PA.
QUARTERMASTERS DEPOT	PHILADELPHIA, PA.

CONNERY CONSTRUCTION CO.
Second and Luzerne Sts. Philadelphia, Pa.

CONNERY
EXPANSION STIFFENED
CONSTRUCTION

The Problem of the 225 p. p. m.

From ILLCO's Case Book of Boiler Feed-Water Treatment . . .

A LARGE PUBLIC UTILITY needed more equipment. Expansion prompted it to find out if there was a better method of water treatment for its boilers (both low and high pressure type). Previously, it had operated with two older and accepted types of treatment. Various concerns were called in, including the Illinois Water Treatment Company.

THE UTILITY'S RAW WATER SUPPLY contained 225 parts per million of dissolved solids, of which 161 p.p.m. were scale-forming. The amount of make-up water required was 32,000 gallons per hour, 24 hours a day.

COMBINATION-REGENERATION equipment was recommended by ILLCO. This consisted of three reactor tanks (9 ft. diameter, 7 ft. high), containing ion-exchange material to be *regenerated simultaneously with salt and acid*—a process pioneered by ILLCO and which has demonstrated its excellence for over five years in leading industrial plants.

PRODUCING THE REQUIRED MAKE-UP of 32,000 gallons per hour of water free from scale-forming solids and having a total dissolved solid content of less than 40 p.p.m., this unit and this method provided the ideal solution.

NOTEWORTHY ADVANTAGES: Lower dissolved solid concentration in the boiler water, therefore fewer blow-downs and a saving of fuel. Less supervision: only attention required is periodic regeneration. Even when raw water supply varies, quality of treated water is maintained. On comparative cost of chemicals alone, equipment will pay for itself in less than four years. Other operating expenses also greatly reduced—less fuel consumption, lowered maintenance, etc.

WITHOUT OBLIGATION we'll gladly make a similar survey of *your* boiler feed-water problem, suggest recommendations, describe our equipment in detail.

Also engineered and manufactured by ILLCO are De-ionizing Units, Softeners, Filters, Aerators, Chemical Processing Equipment, etc. Write for literature.

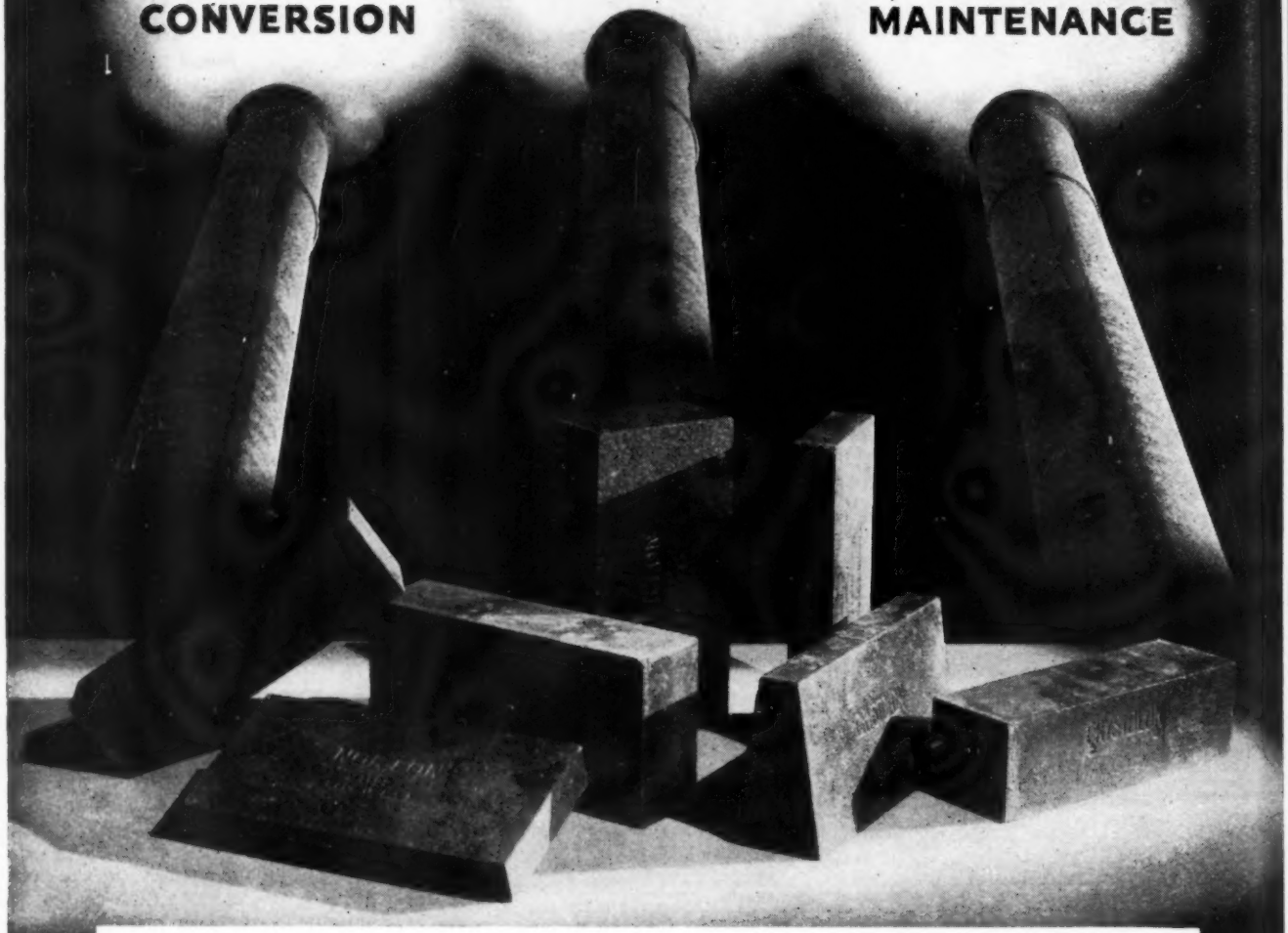
TESTED IN THE LABORATORY • PROVED IN THE FIELD
ILLCO-WAY

ILLINOIS WATER TREATMENT CO.
853 Cedar Street, Rockford, Illinois

Crystolon Brick FOR

LONG SERVICE

CONVERSION MAINTENANCE



When selecting a refractory brick for conversion from oil to coal or for maintenance of your boiler furnaces, specify Norton *Crystolon* Brick and be assured of long, troublefree service. Made of silicon carbide, these brick are particularly recommended for use at the clinker line and bridge wall. The wide acceptance of *Crystolon* Brick for boiler furnaces is largely due to these four outstanding features: (1) resistance to high temperatures, (2) resistance to abrasion, (3) resistance to slag action, (4) resistance to clinker adhesion.

NORTON COMPANY - WORCESTER, MASS.

NORTON ELECTRIC FURNACE FUSED REFRACTORIES

Winning the "*Battle of Production*" involves a lot more than a supremacy of materials, machinery and manpower. One major fire . . . or a small fire that results in crippling damage by the extinguishing medium . . . can halt or slow down war production in a dozen vital plants.

Cardox Fire Extinguishing Systems are guarding against these crippling fires in plants producing a wide variety of critical war products. For example, individually engineered applications are on duty in important plants producing such military necessities as:

Airplanes, Aviation Engines, Aviation Carburetors, Airplane Parts, Engine Parts, Plastics, Rubber Products, Processed Fabric, Tanks, Tank Engines, Cold Strip Steel, Armor Plate, Forgings, Solvents, Motor Fuel, Electric Power.

By instant smothering of fire and cooling of combustibles through the mass discharge . . . at high rate of flow . . . of low pressure, low temperature CO_2, Cardox Systems provide the all-important advantage of fast, complete extinguishment of large or small fires—without damage by the extinguishing medium.

Today, Cardox is concentrating its engineering and manufacturing facilities on two basic activities: (1) Designing and manufacturing of Cardox Fire Extinguishing Systems needed to make it possible for the Armed Forces of America to have more planes, guns, tanks and ammunition; (2) working with industry on plans to increase the efficiency of fire protection both today and after the war.

If you would like more information, write on company letterhead for Bulletin 973.

CARDOX CORPORATION
BELL BUILDING • CHICAGO, ILLINOIS
District Offices in **New York • Washington Detroit • Cleveland • Atlanta • Pittsburgh San Francisco • Los Angeles • Seattle**

★ ***BUY WAR BONDS*** ★

How Cardox Systems Protect War Industries

- Timed discharges, as needed, through built-in piping systems . . . supplied instantly from a single storage unit holding tons (if required) of liquid Cardox CO_2.
- Mass discharge of Cardox CO_2 "knocks out" fire, by . . .
- Reducing oxygen content of the atmosphere below the concentration necessary for combustion, and . . .
- Cooling combustibles and fire zone below ignition temperature . . .
- Extinguishing fire quickly and completely *without* damage from extinguishing medium.

CARDOX—CO_2 Systems with Enhanced Fire Extinguishing Performance

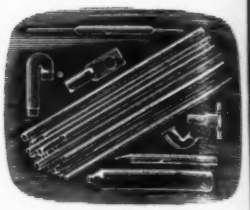
A. Uniformity of CO_2 characteristics.
B. Extinguishing medium with uniformly greater cooling effect.
C. Accurate projection of CO_2 through greater distances.
D. Timed discharges, as needed, through built-in piping systems . . . supplied quickly from a single tank holding tons of liquid Cardox CO_2.

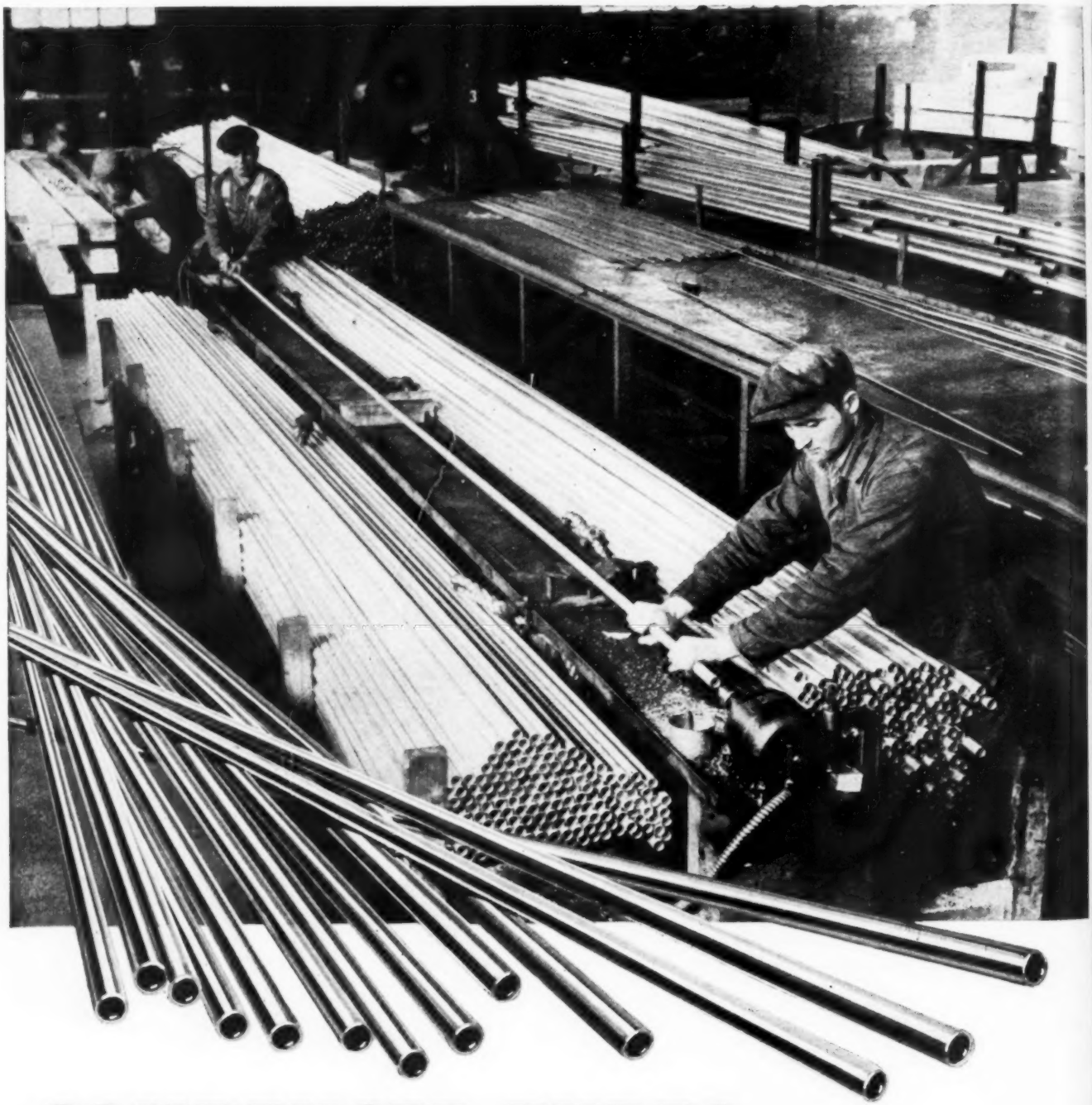
MASS DISCHARGE OF CO_2 · ENHANCED COOLING EFFECT · CENTRAL STORAGE UNIT · AMPLE CO_2 RESERVE · ENGINEERED SYSTEMS · MANUAL OR AUTOMATIC CONTROL

CARDOX

NON-DAMAGING FIRE EXTINGUISHING SYSTEMS

FROM ORE TO FINISHED PRODUCT





CONDENSER TUBES

BUY WAR BONDS

CALUMET AND HECLA CONSOLIDATED COPPER COMPANY

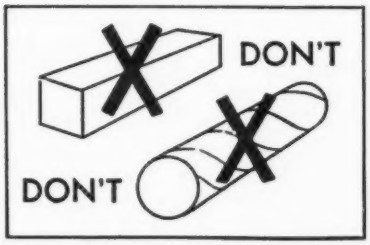
WOLVERINE TUBE DIVISION

Seamless Copper — Brass

1427 CENTRAL AVENUE DETROIT, MICHIGAN

GESS—ORIGINATORS OF SNUBBING PRINCIPLE FOR QUIETING DIESEL EXHAUSTS—BURGESS—ORIGINA

BURGESS SNUBBER BULLETIN on Diesel Exhaust Noise Control



HELPFUL HINTS

Never use flat-sided or thin-walled conduit for exhaust gases

The seemingly unimportant question of what kind of pipe to use to carry exhaust gases from the engine to the Snubber is really a big factor in quiet operation, in order to be sure that vibration and noise are not caused by the wrong kind of pipe. Where the wrong kind of pipe is used, the Snubber is sometimes blamed for noise which is really "pipe noise."

Flat-sided conduits, for example, should never be used. The sides of such rectangular pipes, even when they may seem heavy or rigid, vibrate like diaphragms in tune with the oscillation of the exhaust gases. Not only does this vibration cause "pipe noise," but it may become extreme enough to cause joints to open or the pipe itself to fail in service.

Spiral-welded pipe, or any other pipe which has thin walls, should never be used for exhaust pipe. Such a pipe will "talk" or "sing," causing a great deal of noise which can be completely avoided by using heavier pipe. Once exhaust gases pass through the Snubber, however, their flow is smoothed sufficiently so that any pipe of sufficient mechanical strength can be safely used for a tail pipe.

★ ★ ★

SNUBBING PROCESS THE SAME, WHETHER ENGINE HAS ONE CYLINDER OR EIGHT

Many engineers who clearly understand the exhaust action of a one-cylinder Diesel engine are not so clear in their own minds as to the nature of exhaust flow from a multi-cylinder engine. Basically, there is no difference between their exhaust actions, as can be seen by comparing the exhaust pressure fluctuations of both types.

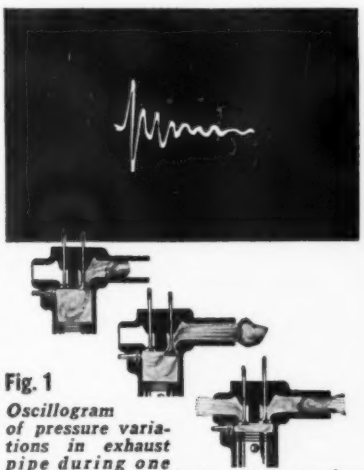


Fig. 1 *Oscillogram of pressure variations in exhaust pipe during one engine cycle of a single-cylinder engine.*

Figure 1 is an oscillogram of the exhaust pressure pulsations for one engine cycle of a one-cylinder engine. When the exhaust valve opens, there is an immediate surge in the exhaust line resulting in a high pressure peak, followed by an opposite reaction causing a negative pressure, and then a series of gradually smaller oscillations until the pressure approaches atmospheric just before the next exhaust impulse. This sequence recurs with each engine cycle and is the characteristic pressure pulsation of a single-cylinder exhaust.

The oscillogram in figure 2, covering one engine cycle of a four-cylinder engine, shows that the characteristic exhaust pressure pulsations occur as in figure 1, only four times as often for the same engine speed. Although the individual wave form varies from that of figure 1, the four individual exhaust impulses follow one another consecutively and each occupies only one-fourth of the complete engine cycle. There is no overlapping of these "slugs," and a snubbing action on this exhaust would be the same as on the one of figure 1. Had an eight-cylinder engine been used, running

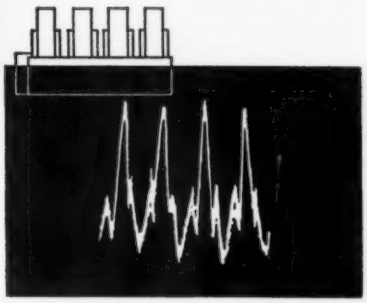


Fig. 2 *Oscillogram of pressures in exhaust pipe during one engine cycle of four-cylinder engine.*

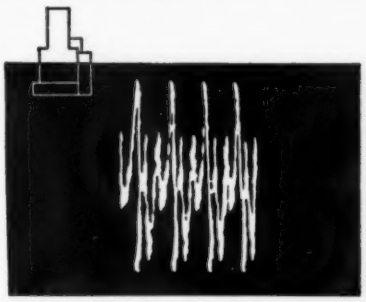


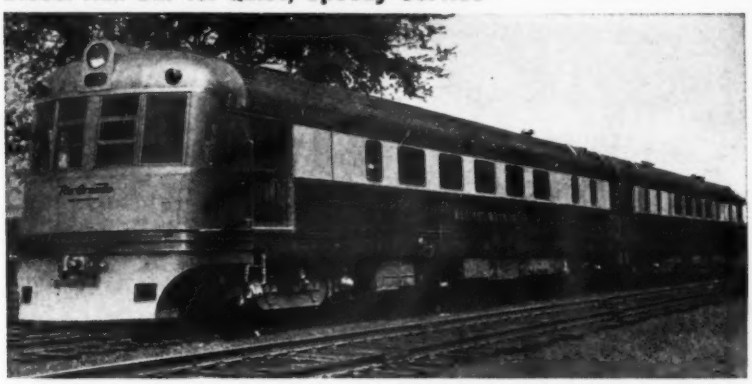
Fig. 3 *Oscillogram of pressures in exhaust pipe of one-cylinder engine at four times normal speed.*

at the same speed, eight of the characteristic pulsations would have occurred.

Figure 3 is taken from the exhaust line of the one-cylinder engine operated at four times normal speed. Here again, four characteristic exhaust pressure pulsations occur. Operating this engine at eight times normal speed would have resulted in eight characteristic pressure pulsations, comparable to those of an eight-cylinder engine.

In any multi-cylinder engine, this same similarity exists; i. e., the only difference between a one-cylinder and a multi-cylinder engine exhaust is the frequency with which the characteristic exhaust pressure pulsations occur. In either type, the Snubber smooths the pulsations and consequently eliminates the noise caused by them.

Diesel Rail Car for Quiet, Speedy Service



The two-car train shown above is one of many such combinations now used by the railroads for short line service. This one, with its twin—both called "Prospectors"—is in regular service on the Denver and Rio Grande Western Railroad. It is powered by four flat-type Hercules Diesel engines, two under each car. There's no exhaust noise to bother passengers, because each engine is equipped with a Burgess Exhaust Snubber to assure quiet exhausts without interference with efficient engine operation.

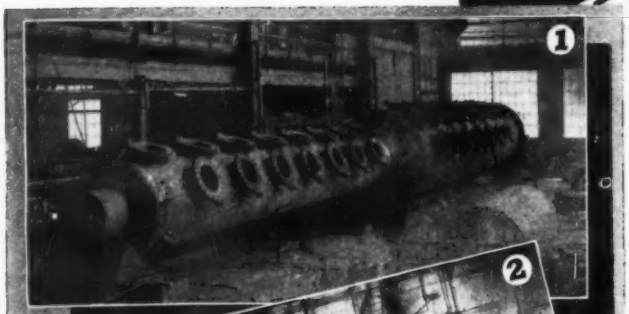
Published by ACOUSTIC DIVISION, BURGESS BATTERY COMPANY—2823-L W. Roscoe St., Chicago, U. S. A.

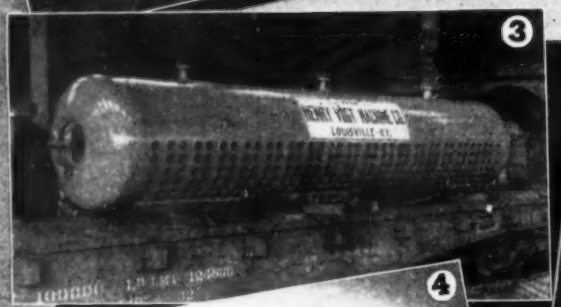
COPYRIGHT 1943—BURGESS BATTERY CO.

ESS—ORIGINATORS OF SNUBBING PRINCIPLE FOR QUIETING DIESEL EXHAUSTS—BURGESS—ORIGINA
OMPLETE SATISFACTION IN EXHAUST AND INTAKE QUIETING—SPECIFY BURGESS SNUBBERS—FOR COM

A.P.I.—A.S.M.E. and A.S.M.E. CODES • CARBON STEEL AND SPECIAL STEEL

WELDED PRODUCTS by Vogt





1 – 4′—0″ dia. x 7′—6″ dia. x 82′—5″ high Stabilizer Tower for a Texas Refinery. Fabricated to A.P.I.-A.S.M.E. Code, stress relieved and X-rayed. 250# working pressure.

2 – Heat Exchangers, for an Eastern Refinery, on the testing floor. Units have fusion welded Monel Metal shells and were built to customer's specifications.

3 – 48″ dia. x 22′—6″ long mud drum for a Vogt Water Tube Boiler designed to operate at 450# S.W.P. Fusion welded to A.S.M.E. Boiler Code.

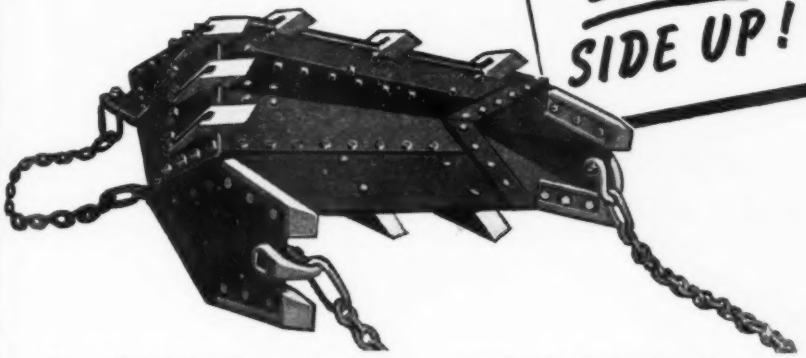
4 – Battery of Absorption Columns in a Western Refinery. Units are 33″ dia. x 41′—0″ high and were stress relieved after welding.

5 – 400 KV Industrial X-ray unit in our plate welding department. Exographs of welded seams can be quickly made because of the special motor operated rolls and traveling carriages which are adjustable to vessels of any size.

HENRY VOGT MACHINE CO.
Incorporated
LOUISVILLE, KENTUCKY
BRANCH OFFICES: NEW YORK · PHILADELPHIA · CLEVELAND · CHICAGO · DALLAS

this cable drag scraper...

...DIGS EITHER SIDE UP!



There is double wear, and no time lost in righting an overturned scraper, when you move stored coal with a Beaumont double-digging-edge unit. Digs evenly with minimum power consumption—pulls and returns without snaking—floats on material when conveying and does not push material on the return. Normally handles coal without digging teeth, which can be added for hard digging. Write today for full details.

In addition to complete dragline coal storage systems, Beaumont Birch manufactures and installs a full range of coal and ash handling equipment.

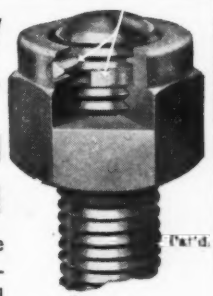
BEAUMONT BIRCH COMPANY
1505 RACE STREET PHILADELPHIA, PA.

ONE CONTRACT—ONE RESPONSIBILITY, FOR COMPLETE COAL AND ASH HANDLING SYSTEMS

HERE'S GOOD NEWS!

UNSHAKO
Reg. U. S. Pat. Off.

SELF-LOCKING NUT DEFIES VIBRATION WON'T SHAKE LOOSE



Cutout Section Showing Locking Ring in Place

A built-in, self-energizing locking-ring works on the principle of a brake band and positively prevents unwinding, yet the nut can be easily backed off and used again and again.

STANDARD PRESSED STEEL CO.
JENKINTOWN, PENNA. BOX 577
— Branches —
Boston • Detroit • Indianapolis • Chicago • St. Louis • San Francisco

Write for more details—today.

QUICK ANSWERS...

to your most troublesome questions on

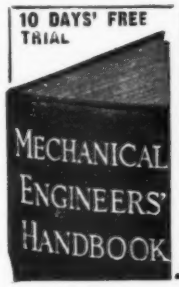
mechanical engineering and applications

Here are 2276 pages of data constantly needed by engineers, machinists, designers, draftsmen, plant and shop employees in every branch of mechanical engineering. Arranged in handy reference form are answers to thousands of questions of every type—covering theory, standards and practice—compiled by experts in many lines.

MARKS' MECHANICAL ENGINEERS' HANDBOOK

4th edition. 2276 pages, over 1700 illustrations, 180 tables, $7.00

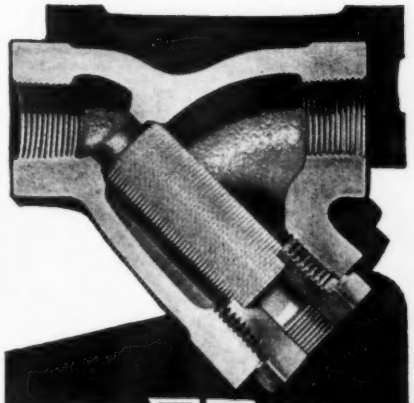
10 DAYS' FREE TRIAL



McGRAW-HILL BOOK CO.,
330 W. 42nd St., N. Y.

Send me Marks' Mechanical Engineers' Handbook for 10 days' examination on approval. In 10 days I will send you $7.00 plus few cents postage or return book postpaid. (Postage paid on cash orders.)

Name .....
Address .....
City and State .....
Position .....
Company .....FP. 7-43



YARWAY STRAINERS
"Police the Pipelines"

YARWAY STRAINERS are *selling by the thousands* because they are better engineered for the service.

"The Screen is the Thing"—a high-grade, woven Monel wire screen that stops the dirt, lets fluids flow freely.

Then too, purchasers like the *body finish—Cadmium plating inside and out* for protection against corrosion.

And last but not least, it is *"Easy to Clean"* having a steel blow-off bushing, precision machined with straight thread. Screen and bushing come out together—go back together, automatically aligning.

Six sizes, ½" to 2" for pressures up to 600 lb serve practically all strainer needs.

Sold by over 100 Mill Supply Houses. See your Supply House or write for Bulletin S-200.

YARNALL-WARING COMPANY
100 Mermaid Ave. PHILADELPHIA

At every temperature from Sub-Zero---to 2500° F.

Carey HEAT INSULATIONS OUTSTANDINGLY DEPENDABLE

There is a CAREY Insulation for *every need.* The complete Carey Line offers you the assurance of maximum efficiency *at every point* where equipment or distribution lines can waste heat.

Perfected through years of research and experience, Carey Insulations reduce fuel consumption to the minimum; stand up under modern temperatures and pressures. Today they are giving outstanding service in the highest-pressure power plants in America; in hundreds of other plants that are noteworthy for efficient generation of power.

(Above) **For High Temperature Equipm (1000°F to 2500°F)** Carey Hi-Temp No. Calcined Aggregate; Dicalite Insulating Pos

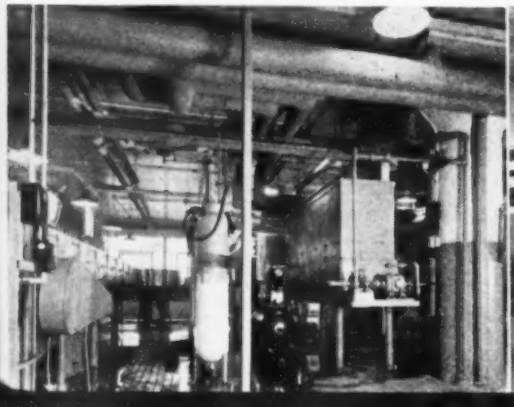
(Below) **For Superheated Surfaces (500°F 1500°F)** Carey Hi-Temp No. 15; Vitricel; B Wool Blankets

Whether you need insulation for 2500° F.; for sub-zero; or any intermediate temperature; you're SAFE with CAREY. A nationwide distribution and engineering organization is at your service. For details, address Dept. 16.

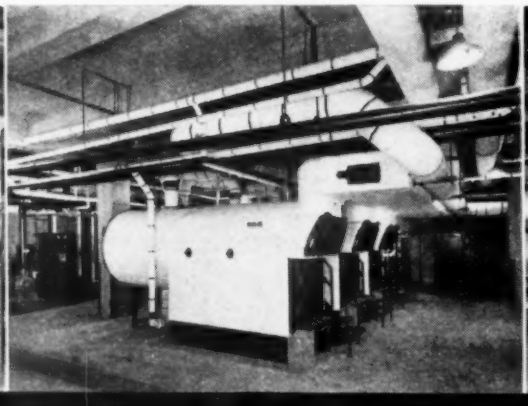
THE PHILIP CAREY MFG. COMPANY • **Lockland, Cincinnati, Ohio**

Dependable Products Since 1873

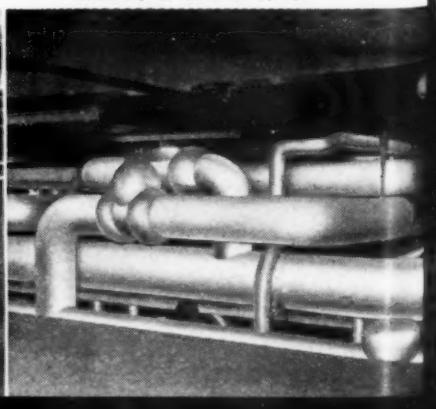
In Canada: THE PHILIP CAREY COMPANY, LTD., Office and Factory: Lennoxville, P. Q.



Cold Water Pipes Carey Impervo; Perfecto; Protecto



Low and Medium Pressure Steam Surfaces (100°F to 300°F) Careycel; Air Cell; Excel



(Below) **Medium and High Pressure Steam Su faces (200°F to 500°F)** Carey 85% Magnesi Multi-Ply or Asbestos Sponge

MAKES WIRE ROPE LAST LONGER!

There are three forces constantly at work to destroy wire rope in use,—(1) wear, (2) fatigue and (3) corrosion. The use of LUBRIPLATE 130-AA as a wire rope lubricant has proven so effective in combatting them that rope manufacturers are recommending it for the toughest rope jobs.

LUBRIPLATE 130-AA has enormous film strength and adhesiveness. Hence it is not squeezed out under the terrific wire rope internal pressures. It is impervious to water, moisture and most industrial fumes. LUBRIPLATE therefore prevents rust and corrosion. By doing a better lubrication job LUBRIPLATE permits the strands and wire to work with minimum friction which materially reduces one of the causes of wire fatigue.

These claims for LUBRIPLATE are backed up by unsolicited testimonials of wire rope users who say that it has licked their wire rope problem. LUBRIPLATE lubricants range from the lightest oils to the heaviest greases. Each is an outstanding lubricant that will do a specific job better. Let us send you facts and figures about LUBRIPLATE lubricants. Write today.

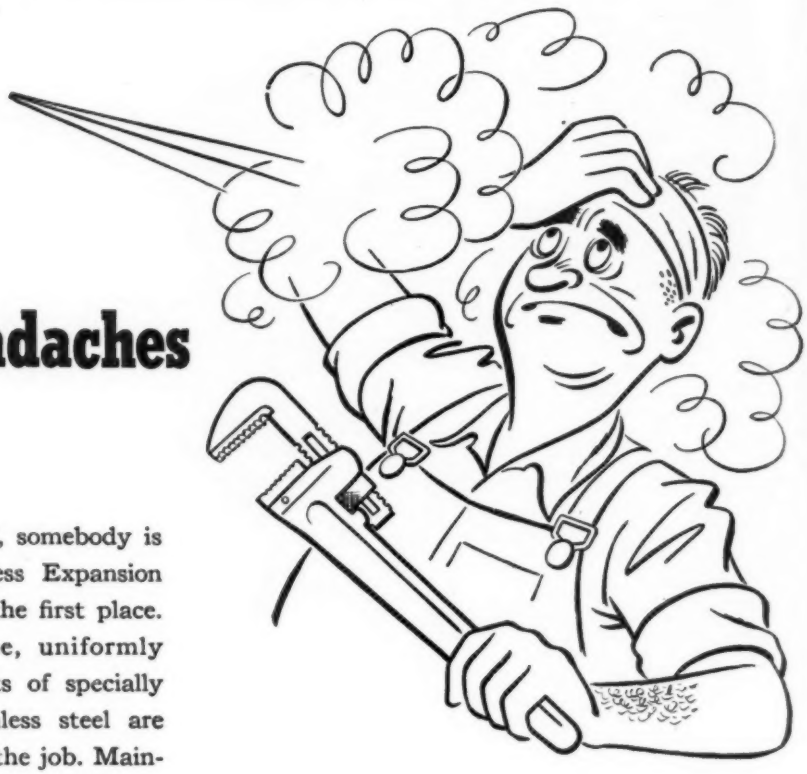
LUBRIPLATE DIVISION

FISKE BROTHERS REFINING COMPANY

NEWARK, N. J. SINCE 1870 TOLEDO, O.

WRITE FOR THE NAME OF THE DEALER NEAR YOU

Cure for headaches



WHEN it's "thar she blows!", somebody is usually sorry Badger Packless Expansion Joints were not installed in the first place. For when these single-tube, uniformly formed corrugated-type joints of specially heat-treated copper or stainless steel are put on the job, they *stay* on the job. Maintenance headaches disappear—shut-downs for packing servicing are non-existent.

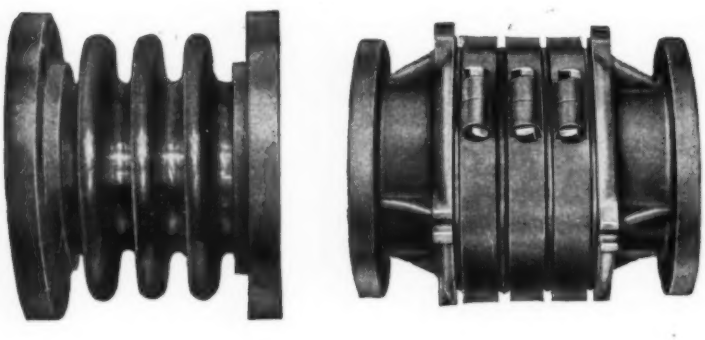
Badger Packless Corrugated Expansion Joints are trouble and money savers anywhere. They are doubly so in underground lines. . . . No manholes needed—no packing to service! They are the perfected product of countless experiments, long engineering experience and close study of performance in actual service.

Badger can offer the Badger Packless Corrugated Expansion Joint for practically every problem where strains must be relieved, vibrations absorbed, or changes in pipe-line lengths compensated for; for high or low pressures, high or low temperatures, and for corrosive conditions when encountered.

E. B. Badger & SONS CO.

75 PITTS STREET, BOSTON, MASS.

AGENTS IN PRINCIPAL CITIES

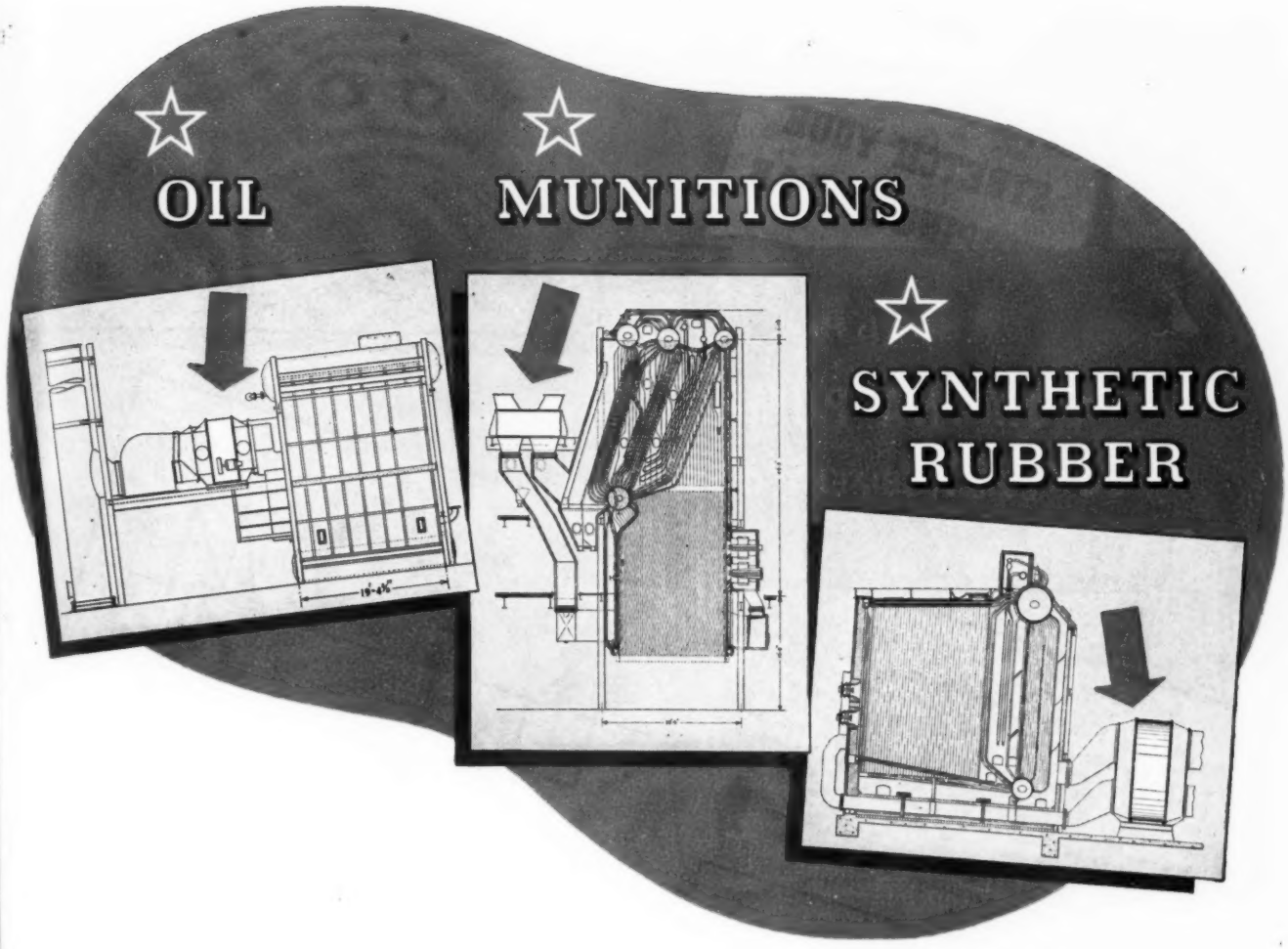


• The flexing member of the Badger Packless Expansion Joint is corrugated by a special process from a single metal tube. Ends are Van Stoned over flanges or homogeneously attached to welding end nipples. Corrugations are fitted with Badger *Directed Flexing* Self-Equalizing Rings, or left plain—depending on type of service required.

BADGER "Packless" EXPANSION JOINTS

CORRUGATED TYPE

IF IT'S **BADGER-MADE** IT'S **GOT SOMETHING!**



Vital war plants boost heat-recovery, save fuel, with Ljungstrom Air Preheaters

PROCESS industries at the heart of the war program are powered by Ljungstrom-equipped boiler plants. The reason? The Ljungstrom Air Preheater combines high operating continuity *with maximum conservation of fuel and steel.*

• • • • •

With preheated air, combustion is more efficient, and poorer grades of fuel can be utilized. Waste-heat becomes an output booster.

In transferring heat from flue gases to incoming air, the Ljungstrom operates on a *continuous regenerative counterflow* principle that permits a reduction of ½ or more in the weight of heat transfer surface, compared to other types. Steel is saved, erection is simplified, and a higher heat-recovery level becomes practical despite today's limitations on construction materials.

In addition, the Ljungstrom has established high records for continuity of service, and normal maintenance is quickly and easily carried out. Gas temperatures as high as 1600°F are being successfully handled in installations in the process industries.

If you have a problem involving gas-to-air heat transfer, why not ask our engineers for application aid. On boiler plants, all major builders are prepared to incorporate the Ljungstrom in their designs.

THE

AIR PREHEATER

CORPORATION

Executive Offices: 60 East 42nd Street, New York, N. Y. • Plant: Wellsville, New York

POMONA PUMPS STRETCH YOUR PUMPING DOLLAR

MINIMIZE YOUR REPLACEMENTS

Here Is How

POMONA PUMPS CUT REPLACEMENT COSTS

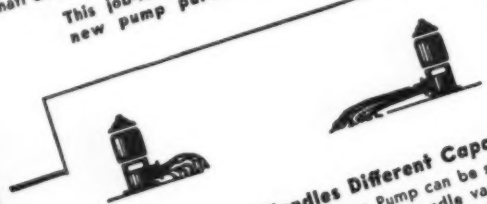
The Same Pomona Handles Different Jobs!
Because Pomonas are unusually adaptable, the same Pomona bought for pumping process solutions from a sump or vat, for example, can be easily converted to deep well primary water supply work by simply adding column pipe and shafting . . . or can be converted to line or booster pumping . . . or can even be mounted on a portable frame and used for shaft dewatering or other similar work.

This job-to-job adaptability means fewer new pump purchases with Pomonas!

To this Pomona Industrial Pump . . .

Add column pipe, and you have a Deep Well Pump

. . . or place in the line for Booster Pumping . . . or mount on an "A" frame for dewatering work!



The Same Pomona Handles Different Capacities:
One important reason why a Pomona Pump can be so readily moved from job to job is its ability to handle varying flow requirements *without wasteful throttling.* Its semi-open impellers can be easily adjusted at the motor for regulating capacity over a range to 60% of design point *with proportionate power savings.* Permits handling widely differing flow requirements without replacing pump or wasting power!

Conventional Flow Pattern

Pomona's Stay on the Job Longer! Pomonas are unique in that the water path through impellers and bowls is free from abrupt changes in direction of flow. Instead, the water rises in a gentle curving flow that reduces friction and abrasion, lengthens life and minimizes replacements. This feature—important in *all* pumping—is particularly vital where unusually gritty or suspension-laden fluids are handled!

Pomona Flow Pattern

IN ADDITION, Pomona Pumps cut replacements because they are self-lubricated by the fluid being pumped, eliminating risk of neglecting lubrication and damaging pump. They have no wear rings to renew or replace. And the bulbous-end vane shape, besides increasing efficiencies above the 90% mark on many sizes within the range, provides additional strength and longer wearing life to pump bowls, further reducing replacement costs!

There are many other important ways Pomonas cut replacements. Your nearby Pomona distributor will gladly supply full details. Why not call him today?

POMONA
Water-Lubricated
PUMPS

JOSHUA HENDY IRON WORKS
POMONA PUMP CO. DIVISION
120 BROADWAY, NEW YORK CITY
Plants: 4301 So. Spring Ave., St. Louis, Mo.
206 Commercial Street, Pomona, California

A LESSON IN WATER COOLING

LESSON 2 OF A SERIES

COOLING TOWER FANS

Practically all cooling tower fans today are of the propeller type, due to this type's simple construction, low cost and ability to handle large volumes of air at relatively low pressures with good efficiency.

Cooling tower fans are mounted in two ways, known as "forced draft" and "induced draft." Following the development of proper methods and reliable equipment to drive the induced draft fan wheel, this type has been used on the majority of mechanical draft towers since it draws air through the decks and falling water at more uniform velocity and with less turbulence or friction loss than the forced draft fan. Being located at top of tower and in a horizontal plane, the induced draft fan provides these additional advantages: (1) less noise, (2) fan wheels of greater diameter can be used, (3) smaller tower area and foundation, (4) winter icing troubles avoided, (5) improved appearance, (6) used air expelled at high velocity from top of tower does not tend to "recirculate." Modern practice favors fans of larger diameters than formerly, so that fewer are required for a given service. The result is less first cost, less wiring and starting equipment, less maintenance and some power saving.

It is good practice to equip fans with two-speed motors. At half speed less than 20% of the total power is used while air volume through the tower is fully 50% or more. Also the two-speed motor provides flexibility in balancing power consumption with load and cold water requirements, facilitates winter operation, and reduces wear and resulting maintenance.

Adjustable pitch fan blades, now widely used, are not an operating feature once the tower is in service but are a means whereby the manufacturer can compensate for variances in altitude, speed and static pressure, thus obtaining desired cfm. at the prescribed brake horsepower.

Good cooling tower fan design embodies such additional features as eased inlet, extended discharge ring, minimum obstruction in inlet or outlet, and motor located outside the air stream.

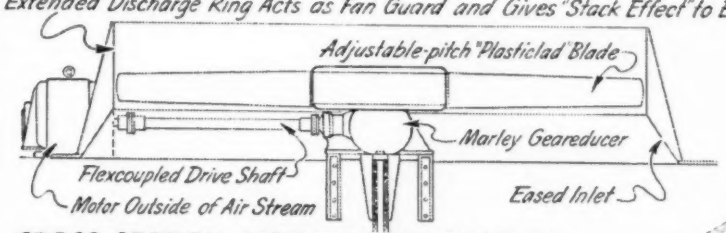
FAN LAWS

For a given fan size, air flow system and air density:

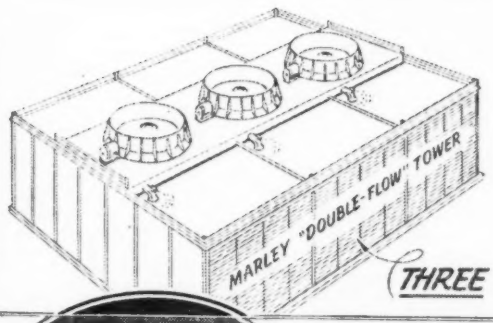
1. **Air capacity varies directly as the fan speed.**
2. **Pressure (static, velocity and total) varies as the square of the speed.**
3. **Horsepower varies as the cube of the speed.**

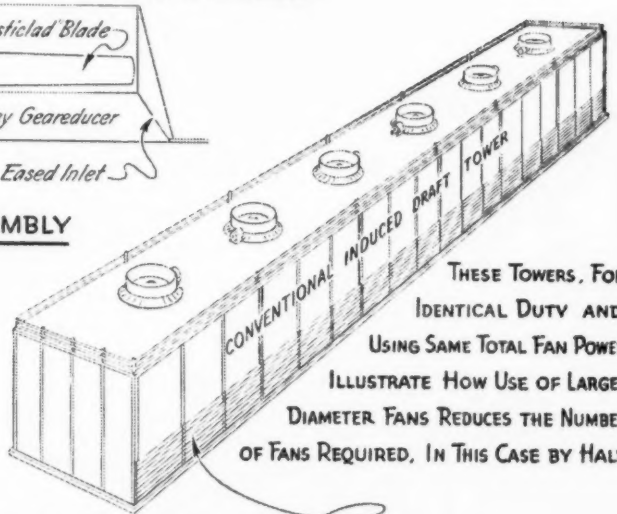
$$\text{Air Horsepower} = \frac{\text{CFM} \times \text{Total Pressure, Inches Water}}{6356}$$

$$\text{Input HP, Motor} = \frac{\text{Air Horsepower}}{\text{Fan. Eff.} \times \text{Drive Eff.} \times \text{Motor Eff.}}$$


Extended Discharge Ring Acts as Fan Guard and Gives "Stack Effect" to Exhaust Air
Adjustable-pitch "Plasticlad" Blade
Marley Geareducer
Flexcoupled Drive Shaft
Motor Outside of Air Stream
Eased Inlet

CROSS SECTION MARLEY FAN ASSEMBLY





THESE TOWERS, FOR IDENTICAL DUTY AND USING SAME TOTAL FAN POWER ILLUSTRATE HOW USE OF LARGE-DIAMETER FANS REDUCES THE NUMBER OF FANS REQUIRED, IN THIS CASE BY HALF

THREE 18 FT. FANS INSTEAD OF SIX 12 FT. FANS

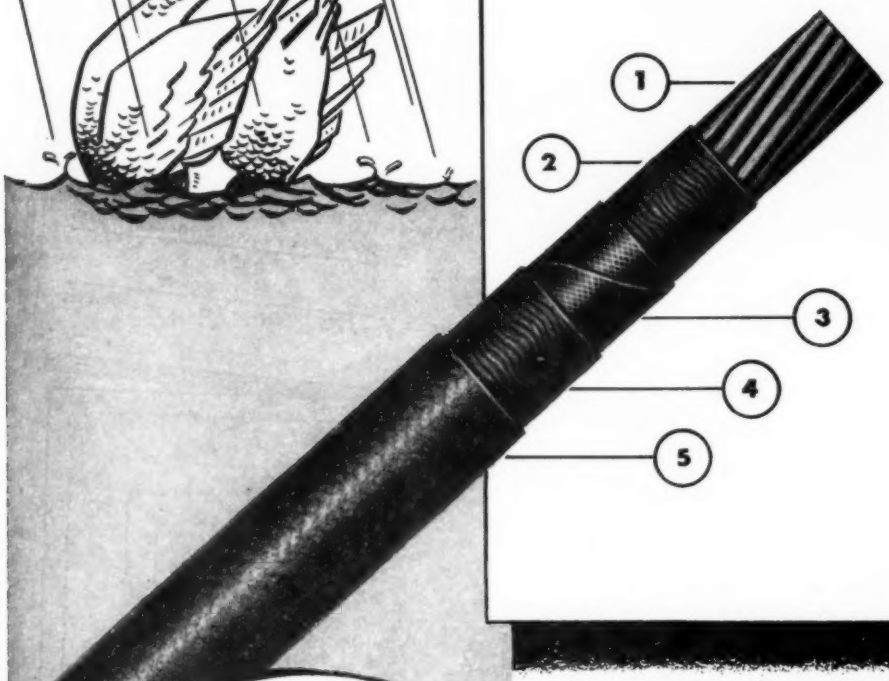
MARLEY COOLING TOWERS

THE MARLEY COMPANY, INC.

FAIRFAX AND MARLEY ROADS — KANSAS CITY, KANSAS

ROCKBESTOS A.V.C. RESISTS MOISTURE

Rockbestos Permanent Insulation Insures Long-Lived Performance



Rockbestos A.V.C. Power Cable illustrated*, and similarly insulated Motor Lead Cable (Underwriters' and Nat. Elec. Code, Type AVA) has a maximum operating temperature rating of 110° C. (230° F.) and this permanently insulated construction.

1. The conductor is perfectly and permanently centered in helically applied insulation that stays put and will not migrate or flow.

2. Felted asbestos insulation that withstands conductor-heating overloads and won't burn even when exposed to copper-melting arcs.

3. Lubricated varnished cambric for high dielectric strength and high moisture resistance, protected from heat, flame and oxidation by two felted asbestos walls.

4. Outer felted asbestos wall which serves as a heat-barrier against high ambient temperature.

5. A tough, rugged asbestos braid, resistant to heat, flame, moisture, oil, grease and corrosive fumes.

**One of 122 different wires and cables developed for severe operating conditions.*

Dampness, humidity and moisture raises hell with wires in electrical circuits that run around steel mill furnaces, finishing stands, soaking pits, boilers, steam tunnels, etc. It rots the insulation, causes shorts, and often ties up important production through wire-failure. You can guard your circuits against this hazard by wiring with Rockbestos A.V.C.—the wire that has ample moisture resistance and, in addition, provides heatproof and fireproof protection. Designed for high temperature locations, *permanently insulated* Rockbestos A.V.C. resists heat, flame, moisture, oil, grease and corrosive fumes. It won't bake brittle, crack, bloom, rot or swell. Prevent wire-failure in your "hot" locations with Rockbestos A.V.C.

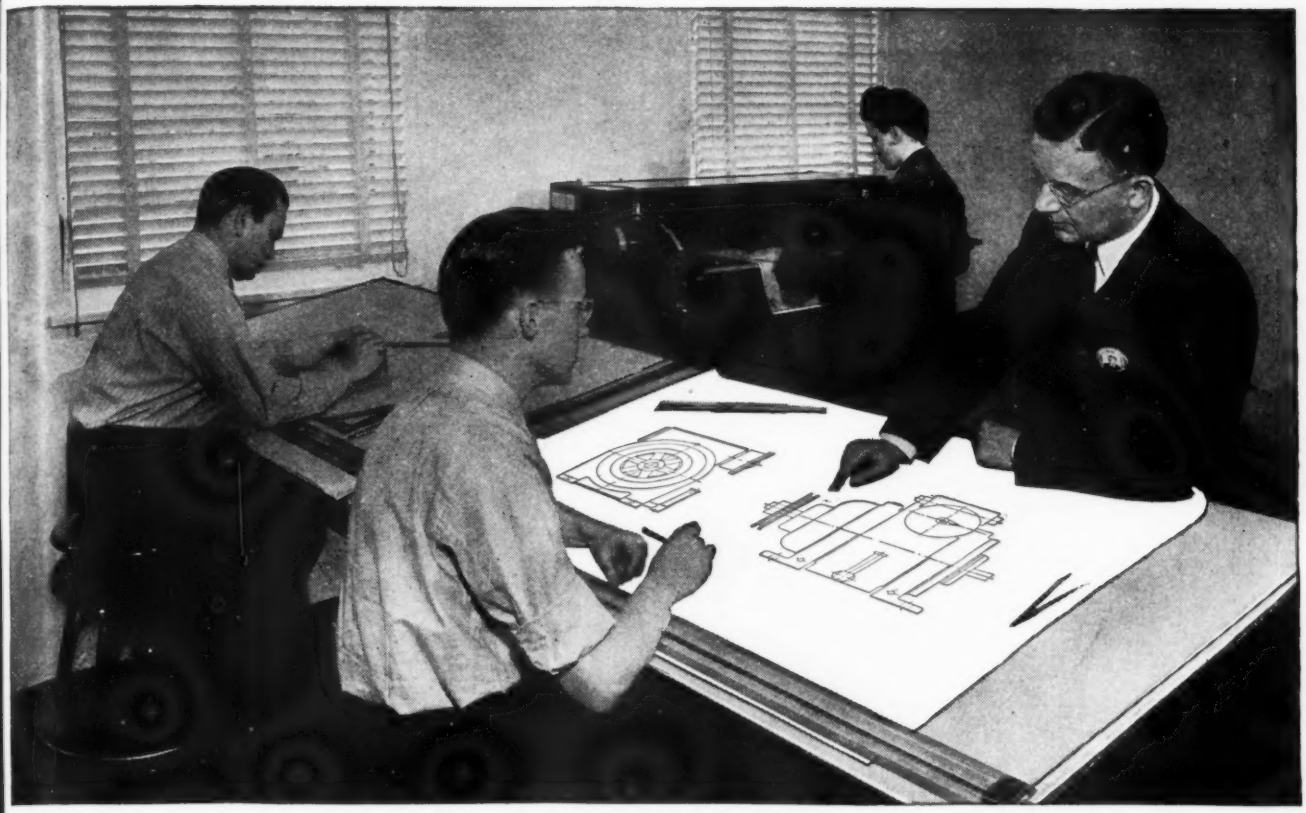
When inquiring or ordering, please furnish CMP certification and allotment number with delivery month. For recommendations write nearest branch office or: Rockbestos Products Corporation, 903 Nicoll St., New Haven, Conn.

ROCKBESTOS A.V.C.

The Wire with Permanent Insulation

FOR VICTORY ★ Invest in United States War Bonds ★

NEW YORK, BUFFALO, CLEVELAND, CHICAGO, PITTSBURGH, ST. LOUIS, LOS ANGELES, SAN FRANCISCO, SEATTLE, PORTLAND, ORE.



Why Ozalid clicks with engineers and draftsmen

STUDY THE cross-sectional drawing of an Ozalid Whiteprint Machine ... It tells much of the story.

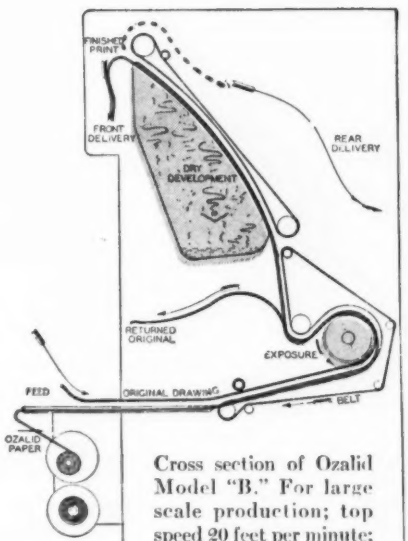
Printmaking is reduced to two operations—Exposure and Dry Development . . . the liquid baths, the plumbing connections, the driers which for fifty years have been a part of blueprinting *are eliminated.* SIMPLIFIED PRINTMAKING allows simplified design—and an Ozalid Machine is so compact that it may be installed right in the drafting room where it can be operated by anyone.

What's most important now, though, is the fact that the Ozalid Process saves thousands of man-hours . . . and that means a big "head start" in war production. When you want to change part of a drawing, it's never necessary to redraw any line which remains the same in the new design. You merely make a transparent print of the original tracing . . . delete the obsolete lines with a corrector fluid . . . and draw in the new design. It's that easy—no Van Dyke tieups, no photographic equipment required.

Ozalid Whiteprint Machines are designed for large scale, medium, and occasional print production. Adopt Ozalid . . . and make positive reproductions *direct* from *your* engineering drawings, charts, and letters.

WRITE FOR "SIMPLIFIED PRINTMAKING."

It shows how leading manufacturers save time, labor, and materials with the Ozalid Process; also contains samples of whiteprints having blue, black, and maroon lines on white backgrounds.



Cross section of Ozalid Model "B." For large scale production; top speed 20 feet per minute; front or rear print delivery; many new features.

OZALID PRODUCTS DIVISION

GENERAL ANILINE AND FILM CORPORATION

Johnson City, N. Y.

Looking ahead with Asbestos

TODAY it's wise to build or make any *necessary* repairs with long-lasting materials. That's why so many builders and home owners are looking ahead by specifying K&M "Century" Asbestos-Cement Roofing Shingles and Siding.

K&M "Century" Shingles and Siding are truly life-time products . . . resistant to fire, weather, rot and termites. You'll find them giving this kind of maintenance-free service—in war housing projects, on homes, farms, industrial plants and commercial buildings—all over the country. You'll recognize them readily by their unique and colorful beauty. It is this quality of distinctiveness that has made "Century" Roofing and Siding such a popular favorite with home owners for years.

Asbestos roofing and sidings are not restricted NOW by Conservation Order L-41

*For reasons of utmost importance to our country's war effort, the War Production Board has revised Order L-41 to permit the use of asbestos roofing and siding wherever maintenance and repair are required, without value or quantity limitations.

*A full explanation of the reasons will be mailed on request.

* * *

Nature made asbestos;
Keasbey & Mattison, America's asbestos pioneer, has made it serve mankind . . . since 1873

KEASBEY & MATTISON

COMPANY, AMBLER, PENNSYLVANIA

Makers of

asbestos-cement shingles and wallboards; asbestos and magnesia insulation for pipes, boilers, furnaces; asbestos textiles; asbestos electrical materials; asbestos paper and millboard; asbestos marine insulations; asbestos acoustical material; asbestos packings; asbestos corrugated sheathing and flat lumbers; asbestos-cement pipe for water mains

Exact INCLUDED ANGLE

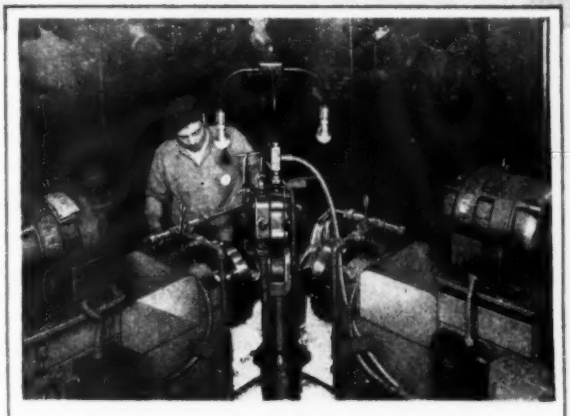
ANOTHER REASON WHY MIDWEST WELDING ELBOWS Are So Often Preferred

There are several important reasons why, among qualified pipe welders, Midwest Welding Elbows have earned a reputation for exceptional dimensional accuracy and uniformity. One reason is because the included angle of 90° or 45° between the machine-beveled ends is always exact . . . both ends are simultaneously machined as shown at the right. The elbow's final sizing in compression makes it possible for the fixture to clamp it in accurate position—so the center-to-end dimension is always the same.

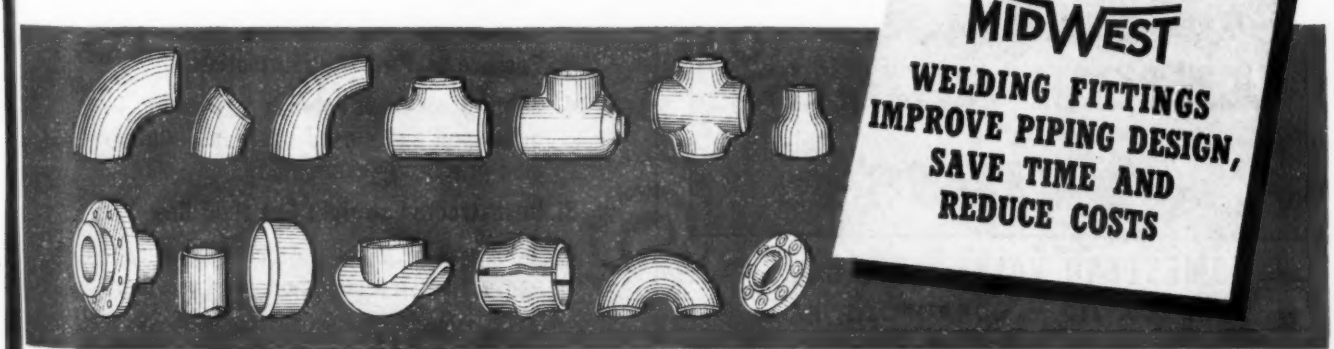
For data on all the advantages of Midwest Elbows . . . and the other Midwest Welding Fittings . . . ask for Bulletin WF-41.

MIDWEST PIPING & SUPPLY CO., Inc.

Main Office: 1450 South Second St., St. Louis, Mo.
Plants: St. Louis, Passaic (N.J.) and Los Angeles
Sales Offices: Chicago—645 Marquette Bldg. • Houston—229 Shell Bldg.
Los Angeles—520 Anderson Street • Tulsa—533 Mayo Bldg.
New York—(Eastern Division) 30 Church Street



Shown here is one of the machines especially built by Midwest for simultaneously machine-beveling both ends of Midwest Welding Elbows and holding the included angle within extremely close limits. Special fixtures and special tools were also developed for this work. Similar machines with three heads are used for finishing Midwest Tees.

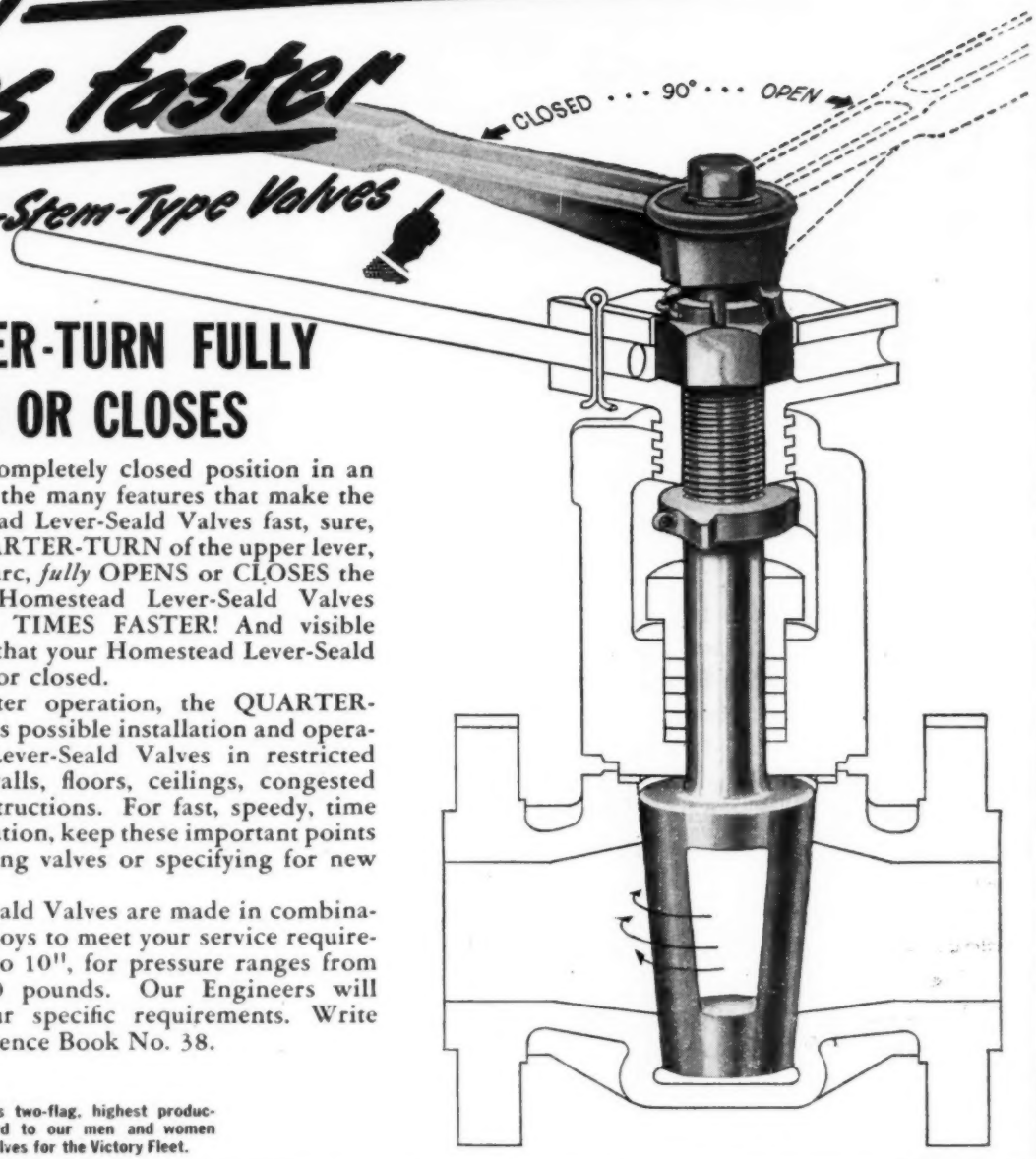


MIDWEST
WELDING FITTINGS IMPROVE PIPING DESIGN, SAVE TIME AND REDUCE COSTS

Homestead Lever-Seald Valves

Operate 16 to 28 times faster

than Screw-Stem-Type Valves



A QUARTER-TURN FULLY OPENS OR CLOSES

From wide open to completely closed position in an instant is only one of the many features that make the operation of Homestead Lever-Seald Valves fast, sure, positive! An easy, QUARTER-TURN of the upper lever, through a 90 degree arc, *fully* OPENS or CLOSES the valve. As a result, Homestead Lever-Seald Valves OPERATE 16 to 28 TIMES FASTER! And visible outside stops tell you that your Homestead Lever-Seald Valve is *fully* opened or closed.

In addition to faster operation, the QUARTER-TURN principle makes possible installation and operation of Homestead Lever-Seald Valves in restricted areas . . . next to walls, floors, ceilings, congested piping and other obstructions. For fast, speedy, time and labor-saving operation, keep these important points in mind when renewing valves or specifying for new installations.

Homestead Lever-Seald Valves are made in combinations of metals and alloys to meet your service requirements, in sizes 1½" to 10", for pressure ranges from 150 pounds to 1500 pounds. Our Engineers will design valves to your specific requirements. Write NOW for Valve Reference Book No. 38.

Maritime's two-flag, highest production award to our men and women making valves for the Victory Fleet.

Homestead LEVER-SEALD VALVES

HOMESTEAD VALVE MFG. CO.,
P. O. BOX 210 · CORAOPOLIS, PA.

1. Instant stick-proof operation.
2. QUARTER-TURN FULLY OPENS OR CLOSES.
3. Positive seal without lubrication.
4. Seating surfaces always protected in both open and closed positions. Corrosion practically eliminated.
5. Unobstructed straight-line fluid flow.
6. All operating parts protected from ravages of service conditions and weather.

THE M. W. KELLOGG COMPANY

Fabricators and Erectors

of

COMPLETE PIPING SYSTEMS

for

HIGH PRESSURE — HIGH TEMPERATURE
PUBLIC UTILITY and MARINE POWER PLANTS

* * *

PROCESS PIPING FOR INDUSTRY

* * *

Heat Transfer Equipment for Industrial and Marine Power Plants

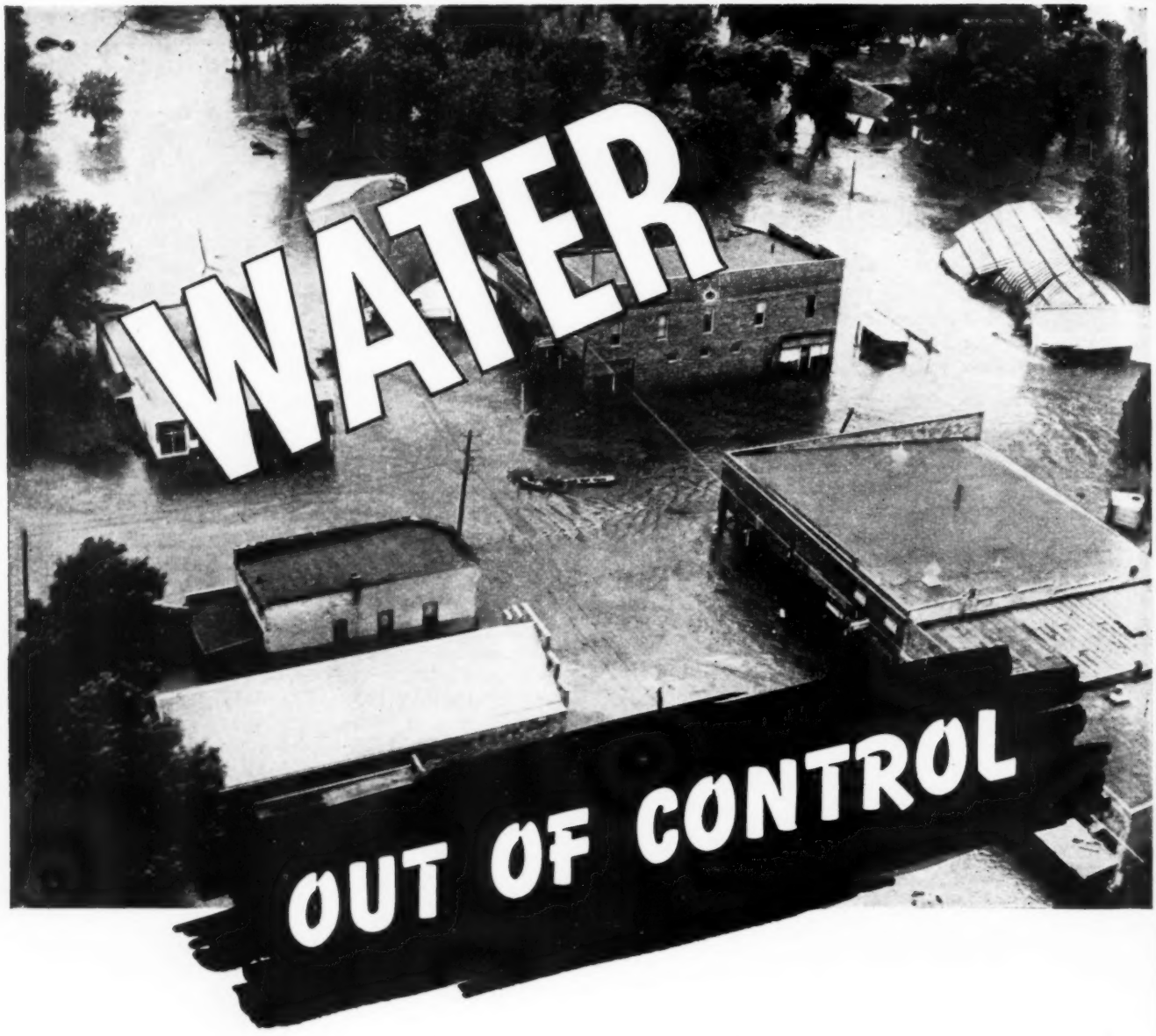
KELLOGG

"Masterflex" Prefabricated Piping Systems • "Masterweld" pressure vessels for Power, Refinery and Chemical Industries. Heat Exchangers. Pyrolytic and Catalytic Cracking Units, Reforming, Dehydrogenation, Alkylation, Desulphurization. Thermal and Catalytic Polymerization Units • JUIK Processes for Lubricating Oil Plants. Plastic Refractories • Radial Brick Chimneys.

THE M. W. KELLOGG COMPANY · JERSEY CITY, NEW JERSEY · 225 BROADWAY, N. Y.

REPRESENTATIVES

LOS ANGELES: 609 SOUTH GRAND — TULSA: PHILTOWER BLDG.



● Flood water is not the only "water out of control" which can leave crippling damage, irreplaceable loss or financial ruin in its path of destruction.

Water . . . uncontrolled . . . carried to vital spots in your plant, can ruin vital power plant equipment, play havoc with your production schedules or waste precious fuel.

Today, as never before, modern water conditioning is a "must" control against destruction by scale corrosion, embrittlement, carry-over, oil, etc.

You are invited to call on Infilco's Chemical Engineering Staff to help in any problem involving boiler or evaporator feedwater treatment, cooling water conditioning, condensate oil removal, steam purification, etc. There is no obligation.

INFILCO

INCORPORATED

325 W. 25th PLACE, CHICAGO, ILL.
***Formerly* INTERNATIONAL FILTER CO.**

INFILCO

ACCELATOR SOFTENERS • CHEMICAL FEEDERS • PROPORTIONERS
WATER FILTERS • CLARIFIERS • CO LING WATER CONDITIONERS
CONDENSATE FILTERS • STEAM PURIFIERS • HOT-FLOW SOFTENERS
LIME-SODA SOFTENERS • ZEOLITE SOFTENERS • CATEXERS

INFILCO

STREAMLINE YOUR ATTACHMENTS

with ROEBLING Swaged Fittings!

FOR THESE AND MANY OTHER ASSEMBLIES

Develop full strength of wire rope up to 1¼ inch in ONE economical fitting

Get wire-rope-rigged equipment back on the job faster . . . release skilled wire rope men for other work . . . by specifying Roebling complete *SWAGED* assemblies that develop 100% of the strength of the rope! *Convenient*—your rope comes to you cut to length and fitted on one or both ends, all ready to go to work. *Economical*—you can get these assemblies for a lot less than it would cost you to splice or socket them on the job.

Swaged fittings as a means of making wire rope connections were popularized by the Aircraft Industry—where speed, uniformity and maximum strength factors are so important. Now you can get these same advantages for all industrial applications where wire rope up to 1¼" diameter is used.

For prompt action—write, stating your requirements briefly. Our engineers will make recommendations on how Roebling Swaged Fittings can be used to best advantage—and quote prices and delivery without obligation.

JOHN A. ROEBLING'S SONS COMPANY

TRENTON, NEW JERSEY

Branches and Warehouses in Principal Cities

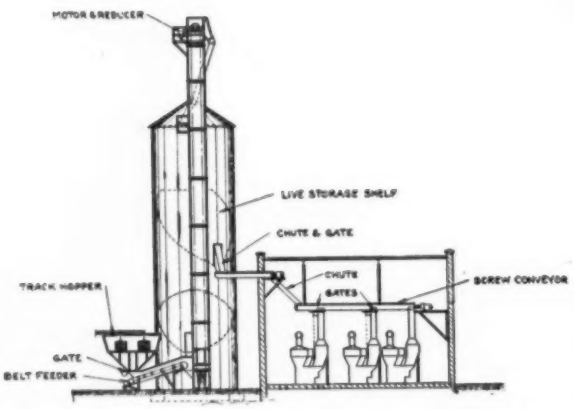
ROEBLING

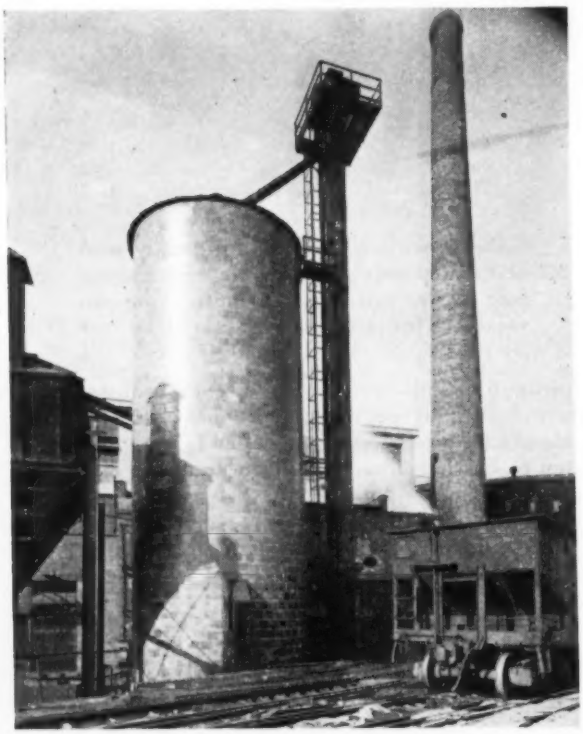
Pacemaker in Wire Products

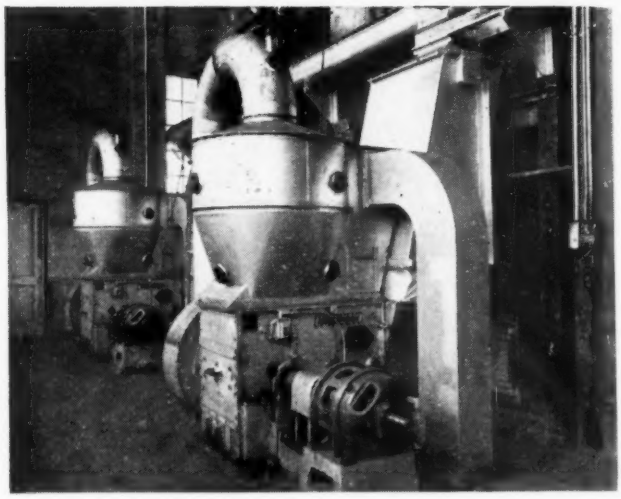
FUEL OIL HAS GONE TO WAR

A formula for Coal Conversion

THE FAIRFIELD SILO SYSTEM







For those manufacturers confronted with the problem of conversion to coal the Fairfield Silo System provides the answer for storage and handling fuel from car to stokers or pulverizers. No dirt—no worry about plant changes—no large storage bins to take up valuable floor space — this modern coal handling system is as compact as it is efficient.

The Fairfield Silo is built to store 100 tons in a 12 ft. dia. space and 500 tons in 24 feet.

Fairfield Engineering presents a complete service from design to finished structure including all allied equipment for handling coal. The Silo being built of vitrified brick does not absorb water. The coal is protected from moisture.

Another advantage is that no critical war material is used—the only steel being used in silo is reinforcing rods.

OUR CATALOG **contains full information on construction and illustrates numerous successful installations. Write for your copy.**

THE FAIRFIELD ENGINEERING CO.- MARION, OHIO
BUILDERS OF COAL AND ASH HANDLING EQUIPMENT

YOU CAN GET MORE POWER QUICKLY..

● If you need more steam now—and can't wait for new boiler deliveries—it will pay you to investigate restokering your existing boilers with Stowe Stokers.

Due to their unique grate construction Stowe Stokers maintain a practically even fuel bed, side to side and front to rear at all times—resulting in ideal burning conditions—minimized draft problems—and exceedingly high heat releases per square foot of grate area.

Records on job after job in the utility, metal working, tobacco, rubber, and other industries, show that boiler outputs have been increased from 33% to 100%, simply by restokering existing boilers with Stowe Stokers.

Recommendations based on your specific conditions and equipment furnished gladly —write—

THE JOHNSTON & JENNINGS CO.
DETROIT 878 Addison Road CHICAGO
CLEVELAND, OHIO
Engineering and Sales Representatives in
NEW YORK • PITTSBURGH • KANSAS CITY • ST. LOUIS

STOWE STOKER
NOT AN UNDERFEED NOT A CHAIN GRATE

HERE'S HELP!

In Training Crane Operators

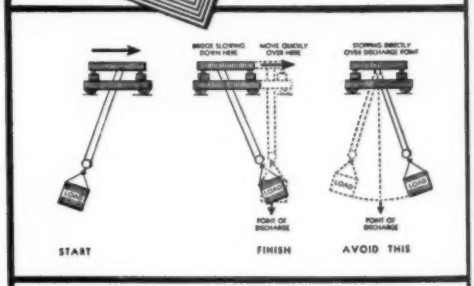
TELLS HOW
and
SHOWS HOW
to operate
efficiently

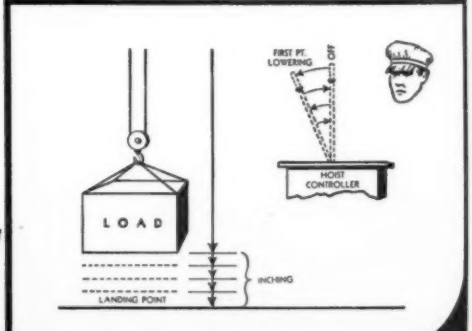
The first Crane MANUAL ON OPERATION ever published

Your copy is free! A simply written, easily understood 48-page Manual. 70 illustrations—two colors—handy, pocket size.

Contents include safety rules—operating hints—inspection-guide for daily report on condition of crane, suggestions on how to avoid trouble, etc. Explains and pictures what *not* to do as well as how to get *more* production safely.

Applies to direct current overhead cranes—*all makes*. Useful in training new operators—including women—also beneficial for the more seasoned operator. Send for your copy to-day. Ask for Booklet 920—"How to Operate a Crane."





Typical illustrations from the MANUAL

THE ELECTRIC CONTROLLER & MFG. CO.
CLEVELAND ★ **OHIO**

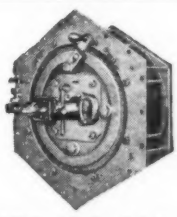
No. 3 in a series of tributes to America's War Industries

What's more—THEY CAN DISH IT OUT!

A Jap naval squadron is finally brought to bay. Like a trapped animal, it fights back ferociously . . . sends a storm of shell-fire thundering through the night. Many miss, some hit . . . and hurt. But the American warships shrug off the blows . . . hurl back five for everyone they take. Another big slice is blasted out of the Nipponese Navy and securely tucked away—in Davy Jones' locker.

Our fighting ships are champions born of America's industrial genius. Broad-shouldered battleships, compact cruisers, lithe destroyers . . . they're the best designed, best constructed, best equipped sea battlers afloat.

As the brains and brawn of American industry launch ships day in and day out, our seven-ocean navy becomes a fighting reality years ahead of schedule. And the smashing of every bottle of champagne is a toast to those enemy ships that still infest the seas. "Bottoms up!"



IN SHIPS OF ALL TYPES

TODD BURNERS

ARE WORKING FOR VICTORY

In hundreds of ships, merchant and fighting, and in war plants of all types . . . wherever trouble-free, dependable combustion is a necessity . . . Todd Burners are delivering unsurpassed performance in the production of heat and power.

TODD SHIPYARDS CORPORATION

TODD COMBUSTION DIVISION

601 West 26th Street, New York City

NEW YORK MOBILE NEW ORLEANS GALVESTON
SEATTLE BUENOS AIRES LONDON

TODD BURNERS ★ ★ ON THE FIRING LINE OF AMERICA'S WAR PRODUCTION FRONT

300 feet of "Lightning" that knows how to strike!

"D-E" Boat is what the Navy calls her! She's a Destroyer Escort—300 feet of "lightning" built to dish out what it takes to make Axis "wolf packs" wish they had stayed home.

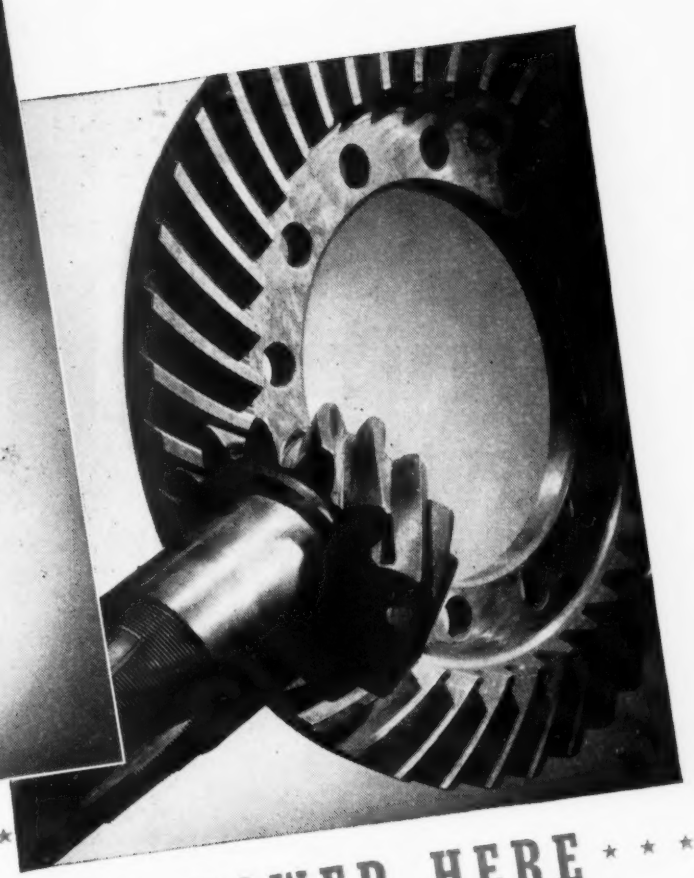
Slim, sleek, and deadly, the D-E's are propelled by Diesel engines and manned by crews who know how to do the job assigned them.

Many of the Diesels for Destroyer Escorts and other U. S. Navy warships are of Fairbanks-Morse manufacture. The skill, facilities, and engineering experience that have given Fairbanks-Morse Diesels a world-wide reputation for dependability are now being used to provide dependable power for U. S. Navy craft—when dependability is so important. Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.

FAIRBANKS-MORSE

DIESEL ENGINES
PUMPS
MOTORS
GENERATORS
SCALES
WATER SYSTEMS
FARM EQUIPMENT
STOKERS
AIR CONDITIONERS
RAILROAD EQUIPMENT

Diesels



LESS WEAR HERE * * * MORE POWER HERE * * *

at the same time

RING-FREE REMOVES CARBON

This is no time to let carbon and unnecessary wear waste hard-to-replace parts . . . waste fuel . . . waste productive horsepower. Lubricate your power plant more efficiently with Macmillan RING-FREE Motor Oil. By reducing friction *fast*, RING-FREE delivers direct to the driveshaft more of the horsepower ordinarily wasted in overcoming motor friction. And in addition, it actually removes carbon while the engine runs! Carbon removal is a natural RING-FREE function, inherent in the crude oil and retained by the exclusive Macmillan patented refining process. To remove carbon . . . to minimize "downtime" . . . to get maximum fuel conservation . . . and to get all-out performance — start using RING-FREE now!

Macmillan RING-FREE Motor Oil combines these vital qualities: **1**—Removes Carbon, **2**—Reduces Friction *Fast,* **3**—Saves Fuel, **4**—Has Great Film Strength, **5**—Has High Heat Resistance, **6**—Long Cling to Metal, **7**—Fast Penetration, **8**—Is Non-Corrosive, **9** — Is Less Affected By Dilution.

MACMILLAN PETROLEUM CORP.

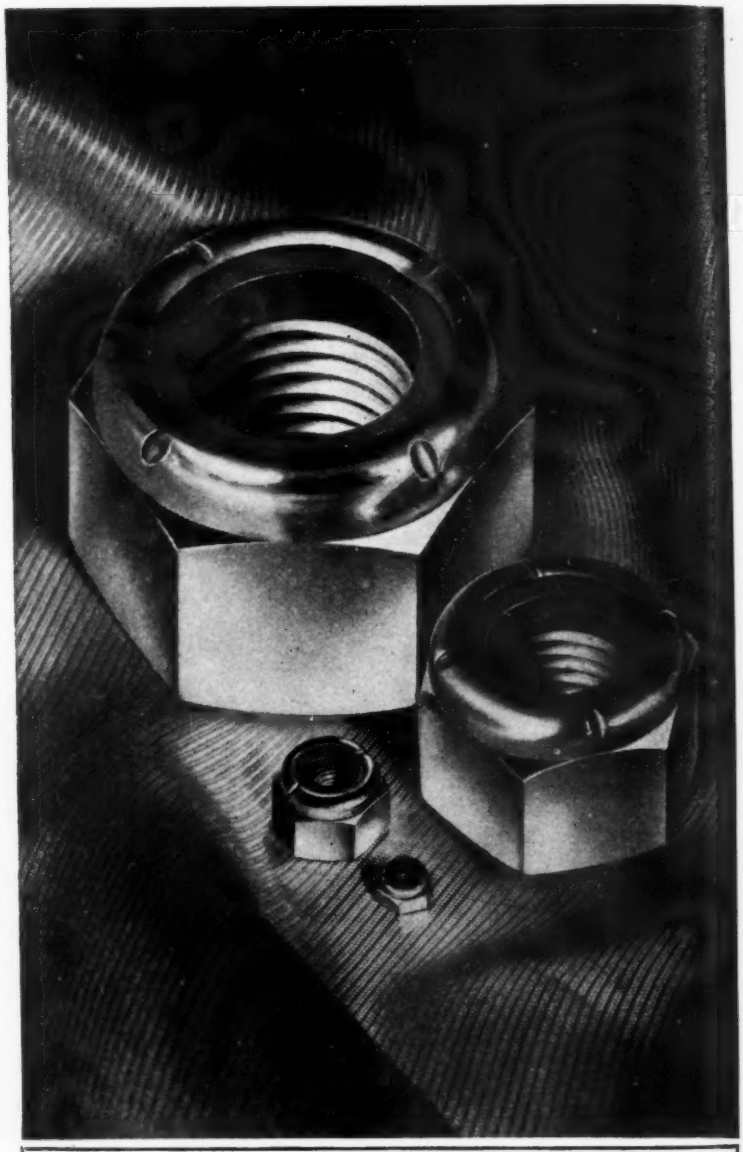
50 W. 50th St., New York • 624 S. Michigan Ave., Chicago • 530 W. Sixth St., Los Angeles

Copyright 1943 Macmillan Petroleum Corp.

MACMILLAN
RING-FREE
MOTOR OIL

REDUCES WEAR BY REDUCING FRICTION

They're the NUTS for tough fastening jobs



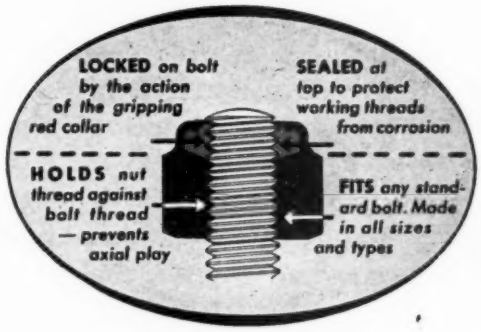
There are more Elastic Stop Nuts in America's planes, tanks, guns, naval vessels and production equipment than all other lock nuts *combined*.

All because these nuts stay put.

The reason is the red elastic locking ring in the top. This grips the bolt and holds the threads in pressure contact. And chance of wobbling and axial play is eliminated.

Looking ahead, we see better products and manufacturing equipment — we see time and money saved in maintenance and replacements — all because of these nuts that have proved they hold fast even under grueling vibration — that are easy to put on and take off yet lock automatically anywhere on the bolt.

Our engineers, experienced in solving fastening problems both in peace and war, are ready to share their knowledge with you. They will gladly work with you and recommend the correct Elastic Stop Nut to meet your need.

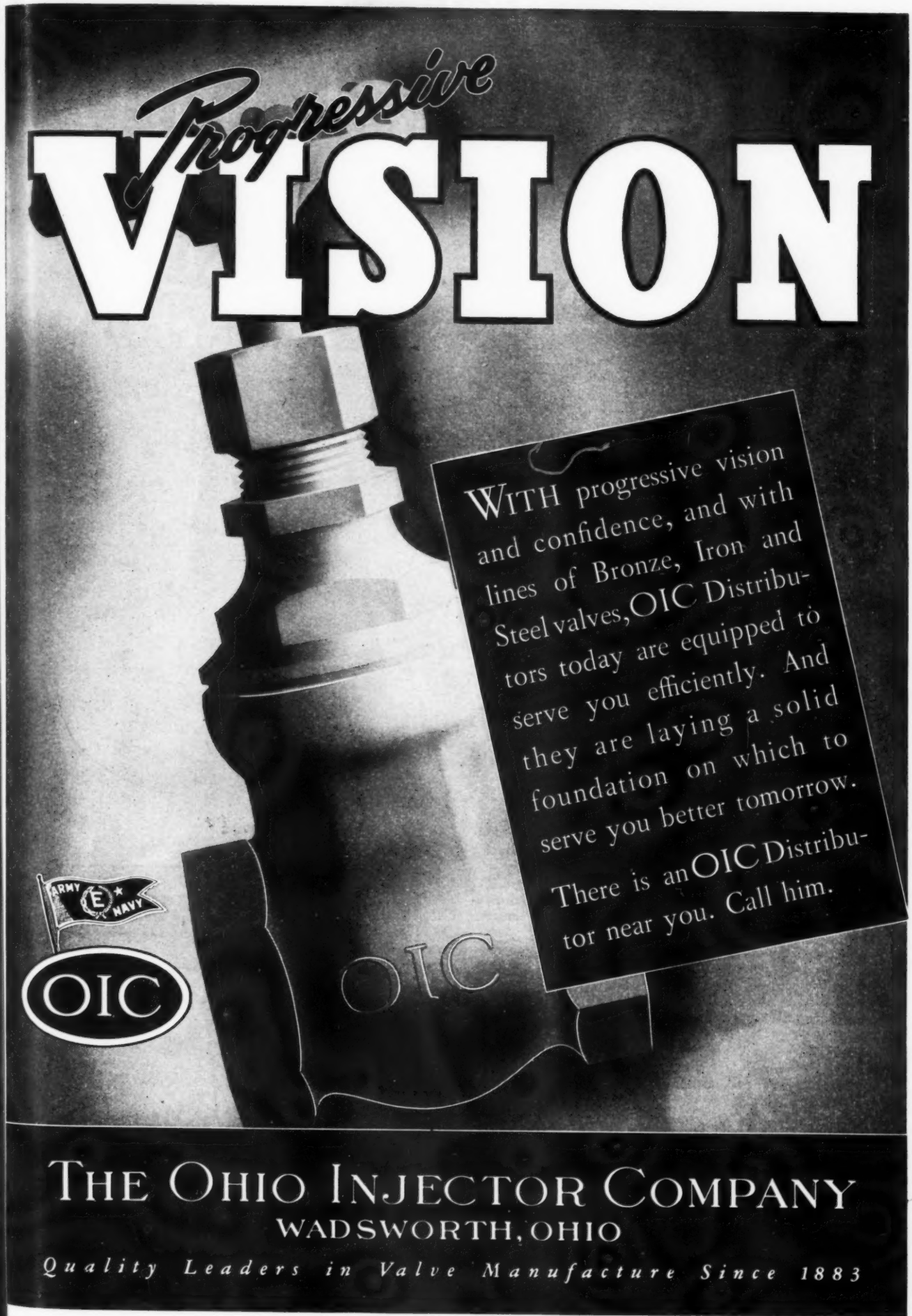

LOCKED on bolt by the action of the gripping red collar
SEALED at top to protect working threads from corrosion
HOLDS nut thread against bolt thread — prevents axial play
FITS any standard bolt. Made in all sizes and types

ELASTIC STOP NUTS

Lock fast to make things last

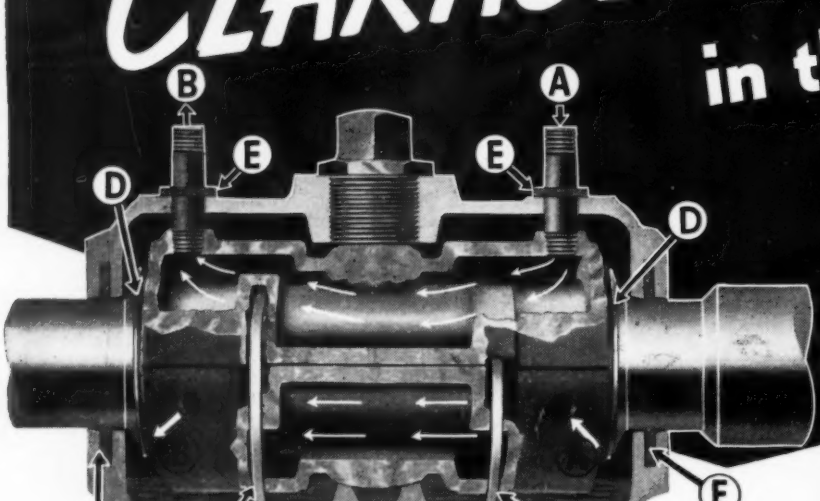
ESNA
TRADE MARK

ELASTIC STOP NUT CORPORATION OF AMERICA
UNION, NEW JERSEY AND LINCOLN, NEBRASKA


Progressive
VISION
WITH progressive vision and confidence, and with lines of Bronze, Iron and Steel valves, OIC Distributors today are equipped to serve you efficiently. And they are laying a solid foundation on which to serve you better tomorrow.
There is an OIC Distributor near you. Call him.
ARMY E NAVY
OIC
OIC

THE OHIO INJECTOR COMPANY
WADSWORTH, OHIO
Quality Leaders in Valve Manufacture Since 1883

Another Reason Why CLARAGE is Ace-High in this Toughest of ALL Fan Services



A—Water Inlets. B—Water Outlets. C—Oil Rings. D—Thrust Collars (forged, turned and ground); integral part of shaft. E—Seals prevent dust leakage into bearing.

A—Water Inlets. B—Water Outlets. C—Oil Filler Cup and Pipe. D—Bottom of Bearing and top of Support machined for accurate alignment. E—Shaft Seal prevents escape of gases from fan.

BETTER BEARINGS GUARD Against Operating Failures on Vital War-Time Jobs!

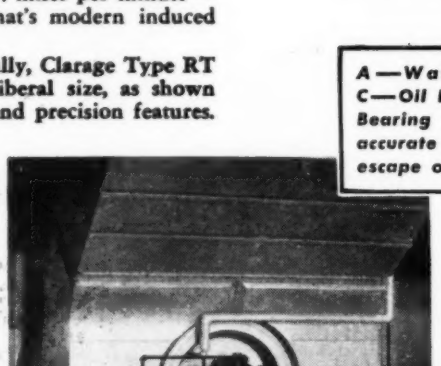
Wheel tip speeds may run as high as 4 miles per minute—temperatures may exceed 700° F.—that's modern induced draft—*toughest of all fan services!*

To meet such requirements successfully, Clarage Type RT Fans have water-cooled bearings of liberal size, as shown above. Note high grade construction and precision features.

Note, too, that cooling water is circulated through each half of the bearing sleeve independently of the other—no joints or gaskets—no possibility of water leaking into bearing lubrication.

These BETTER bearings are an important factor in assuring each Clarage RT Induced Draft Fan a trouble-free service life far longer than normal expectancy.

And this ability to out-perform and out-last is equally characteristic of other Clarage Fans and Blowers. If you have ANY war-time air-handling problem, it will pay you to get in touch with us.



RT Induced Draft Fan servicing public utility—one of over 2,000 Clarage power plant installations. Water-cooled bearings in foreground — big husky ones OK for any operating condition.

COMPLETE AIR CONDITIONING
•
COOLING
•
VENTILATION
•
FACTORY HEATING
•
MECHANICAL DRAFT
•
FANS and BLOWERS for INDUSTRIAL NEEDS

Clarage Fan Company Kalamazoo, Mich.

APPLICATION ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

TALON, INC.

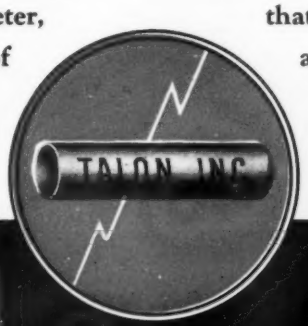
Steel Tube Division

Successors to

ELECTROWELD STEEL CORPORATION

TALON STEEL TUBE DIVISION manufactures pressure and mechanical tubing on most modern and up-to-date equipment. These excellent production facilities, plus scrupulous care by skilled workmen during each operation, give you assurance that every length of tubing is uniform and has these important high qualities: uniform diameter, uniform wall thickness, uniformity of structure in the weld area, plus square and uniform cuts which permit savings of real importance.

Talon's Steel Tube Division has a substantial capacity devoted entirely to the war effort . . . another mill, now under construction, will increase even further Talon's production of steel tubes. When victory be ours, we believe that this excellent product will prove advantageous in your peacetime production operations. . . . . .



TALON . . . . . INC.

STEEL TUBE DIVISION **OIL CITY, PENNA.**

UNIFORMITY HERETOFORE UNKNOWN!

PLANT PRECISION MOLDED

REG. U. S. PAT. OFF.

85% MAGNESIA

"THE DEPENDABLE STANDARD—MODERNIZED"

*U. S. Patent Nos. 2,131,374, 2,209,752, 2,209,753, 2,209,754

Modern engineering called for a new, higher, more precise standard of heat-insulation performance — and here it is! The new, patented* Plant *Precision Molded* process capitalizes upon the time-tested insulation-superiorities of 85% Magnesia—and achieves a brand new level of efficiency and dependability.

Plant *Precision Molded* 85% Magnesia weighs just 11 lbs. per cubic foot density instead of the usual 16.8 lbs. In addition to this unprecedented light weight, it also brings many other timely advancements, including new, lower thermal conductivity, greater "ductile strength" and added durability.

Every engineer will want to study the complete data about this revolutionary new product. Write today for descriptive material.

PLANT'S PLUS TOLERANCE IS ONLY ½ LB. PER CUBIC FOOT!
Thus assuring a new, remarkable degree of control over such factors as Weight and Thermal Conductivity. Other controlled factors include size, thickness and fibre distribution.

NOTE ITS S-M-O-O-T-H F-I-N-I-S-H, TOO!
By the patented Plant *Precision Molded* process, the 85% Magnesia is molded to exact final size and thickness—NOT molded oversize and then "milled" or "machined" to size! Result — faster, easier application, with precision pipe fit and a smooth, strong "rind" on both inner and outer surfaces of pipe coverings and on face and sides of blocks.

COMPLETE RANGE OF SIZES AND THICKNESSES IN BLOCKS AND PIPE COVERINGS

PLANT
RUBBER & ASBESTOS WORKS
Manufacturers of Plant Insulating Materials and Mechanical Packings Since 1920

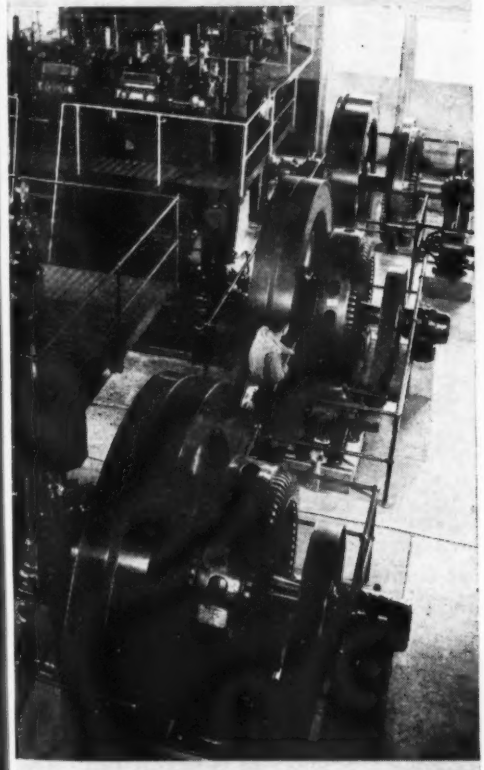
MAIN OFFICE: SAN FRANCISCO
Sales Offices in Los Angeles, Wilmington, and Oakland, Calif.; distributors in principal cities.
Factories in Emeryville, San Francisco, and Redwood City, Calif.

Buy U. S. WAR BONDS

The **why** *of better Diesel Lubrication with Gulf Parvis Oil:*

1. Higher Lubricating Value—for more effective protection

2. Greater stability and endurance—for longer lasting protection



"Gulf Parvis Oil is the most satisfactory Diesel lubricant we've ever used," says the Chief Engineer of a large municipal power plant. "With this quality oil in service, our overall efficiency is greater and our maintenance costs are lower."

The *higher protection value* of Gulf Parvis Oil stands out today—when power demands can usually be met only by peak-load and over-load operation of Diesel units. For severe service proves the exceptional endurance and stability of this oil. Its tough film stands up and provides full protection under conditions which often cause excessive wear, high maintenance expense, and below-standard Diesel performance.

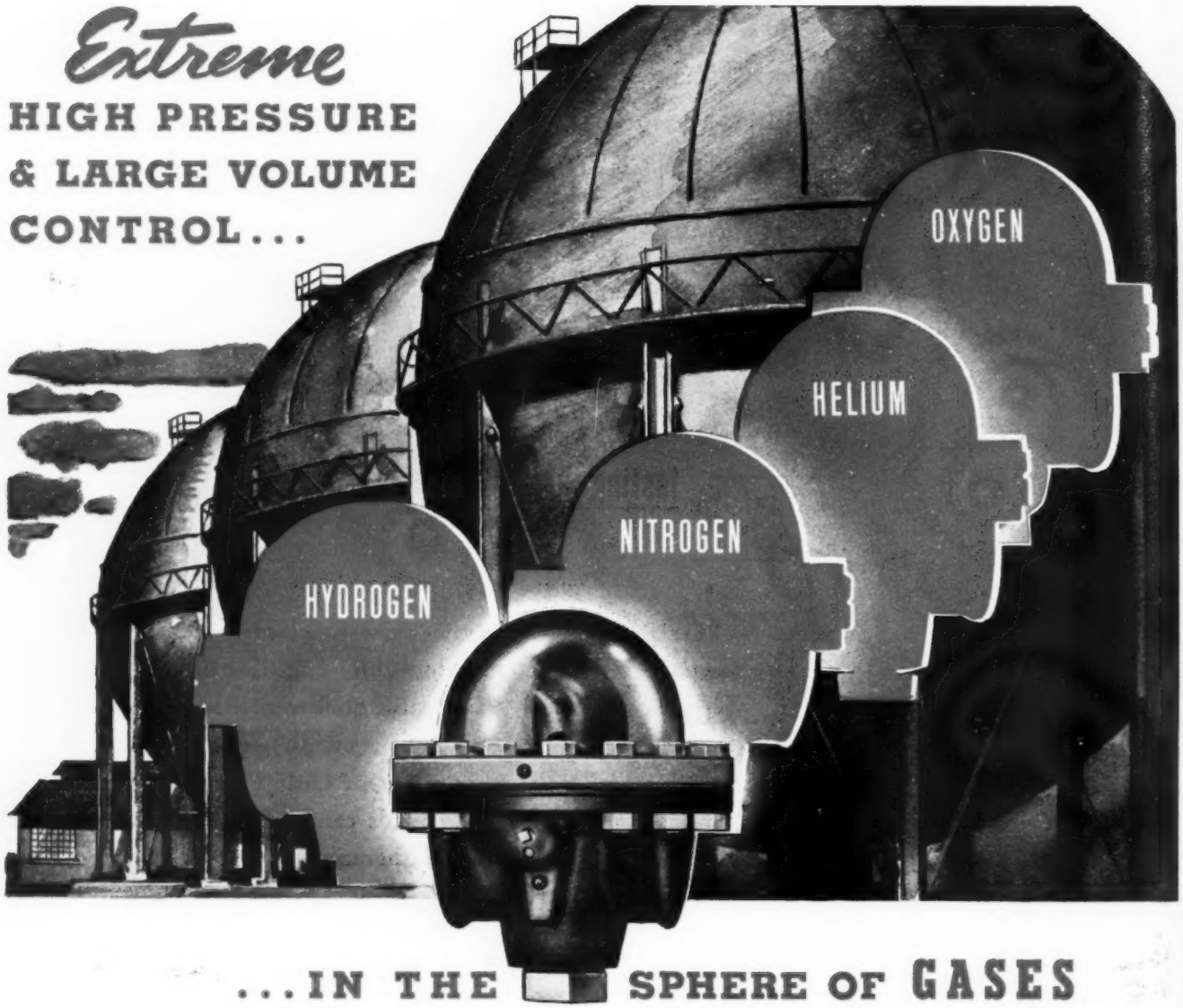
For maximum efficiency and highest operating economy in *your* plant, call in a Gulf Lubrication Service Engineer now and ask him to recommend the proper grade of Gulf Parvis Oil to fit your particular equipment and operating conditions. His thorough training and broad experience with all types of Diesel engines is your assurance of sound and helpful recommendations. Write or 'phone your nearest Gulf office today.

GULF INDUSTRIAL LUBRICATION

Gulf Oil Corporation · Gulf Refining Company

Gulf Building, Pittsburgh, Pa.

Extreme
HIGH PRESSURE & LARGE VOLUME CONTROL...



...IN THE SPHERE OF GASES

GROVE PRESSURE CONTROL SYSTEMS AND EQUIPMENT INCLUDE:

* AIR, GAS AND STEAM PRESSURE REDUCING VALVES
* REMOTE CONTROL SHUT-OFF VALVES
* AUTOMATIC REDUCING AND STOP VALVES
* FLEXIBLE TUBE TYPE VALVES
* COMPLETE PRESSURE CONTROL SYSTEMS

WRITE TODAY FOR BULLETIN!

Grove Powreactor Dome Regulators far exceed the capacity and limit of ordinary pressure reducing valves, in the control of large volumes of gases, at extreme high pressures. Being of the pressure balanced type, Grove Pressure Control Valves are entirely automatic in their operation. A wide range of models and sizes are engineered to safely handle helium, nitrogen, oxygen, hydrogen and other gases at pressures up to 6000 lbs. They are so designed and built that they will dependably control all pressures with the same high degree of accuracy—reducing 3000 lbs. to 500 lbs. just as accurately and safely as reducing 50 lbs. to 5 lbs. Complete details are contained in Grove Pressure Control Bulletin 123-A, furnished on request.

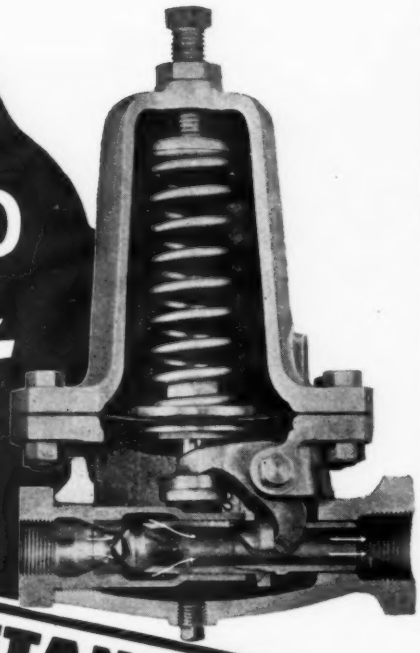
GROVE

GROVE SIMPLICITY ACCURACY SAFETY

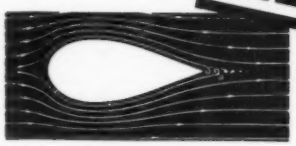
Pressure Control
SYSTEMS & EQUIPMENT

GROVE REGULATOR COMPANY
1190 67TH STREET, OAKLAND, CALIFORNIA
BRANCH OFFICES: 5644 NAVIGATION BLVD., HOUSTON, TEXAS • 30 ROCKEFELLER PLAZA • NEW YORK CITY, N.Y.

PUT IT ON THE LINE AND *forget it*



CASH STANDARD *Streamlined* PRESSURE REDUCING VALVE TYPE 1000



Streamlined
FOR SMOOTH EVEN FLOW
of Steam, Water, Air, Oil, Etc.

● That is the Streamline story in a nutshell. The way it works is the answer—from inlet to outlet the fluid flows through this valve in a straight line—a streamline. There is no detour around a dividing wall—the direction of the flow is not changed at right angles because of a seat wall AND the flow is not broken up by valve stems, springs, or other parts. Forget it once it's installed like others do. PROOF: "We have a large number of buildings scattered over about 100 acres of land. Just where we installed these Streamlined Valves I dont know. But I do know that I haven't seen or heard of them since they were installed."—Case No. 343. PROOF: "We installed four or five of your Streamlined Regulators. The last I heard of them they were holding pressure the same as when we first installed them. And as far as I know no one has ever touched them."—Case No. 345.

Bulletin 1000 will give you full details.

YOU GET MAXIMUM CAPACITY WHEN IT IS NEEDED MOST

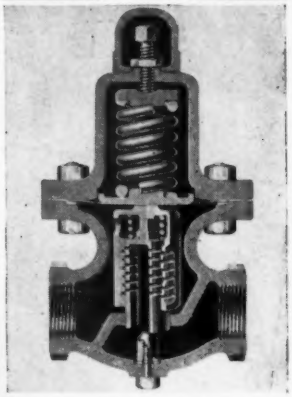
TROUBLE-FREE SERVICE	CONSTANT DELIVERY PRESSURE
SMOOTH OPERATION	PRACTICALLY ZERO IN MAINTENANCE COST
TIGHT CLOSURE	SPEEDIER PRODUCTION RESULTS
NO SPOILAGE	COST-SAVING OPERATION

ACCURATE PRESSURE CONTROL AT ALL TIMES

CASH STANDARD CONTROLS.. VALVES

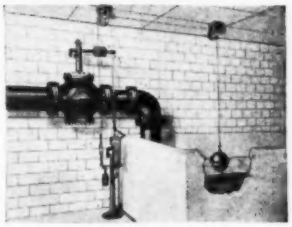
A. W. CASH COMPANY
DECATUR, ILLINOIS

OTHER VALVES *from the* CASH STANDARD LINE

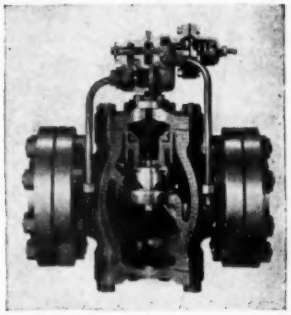


Cash Standard Type 4190 Valve; holds constant back pressure on inlet side regardless of variation in outlet pressure or changes in load. A multiport, large capacity valve. Used on suction line in refrigeration practice. Also as bypass valve for oil pumps.

Iron or bronze bodies; iron trim. Screwed ends ½" to 2"; flanged ends 2" to 6".



In automatic liquid level work, Cash Standard controls: (1) to hold the level within the closest kind of limits; (2) to do it dependably. In the cut above, a Type 100-L Controller operates a 12" Balanced Valve regulating liquid supply to a large tank. It is pilot actuated for sensitivity. It has operating power to spare—for any size Valve, however large.



Cash Standard Type 10 Pressure Reducing and Regulating Valve—self-contained, pilot operated. For holding reduced pressure within extremely close limits.

Sizes: 2" to 12" inclusive. Highest initial pressure 600 lbs.; highest reduced pressure 250 lbs. For use with water, air, Freon, ammonia; or with any non-corrosive gas or oil. Valve operating fluid not wasted; it discharges to outlet pipe. Bodies: iron, bronze, steel. Trims: iron, bronze, stainless steel, monel.

Ask for these Posters

AUTOMATIC BLOW GUNS
SAVE EFFORT TIME AIR
GOOD AIR HOSE IS PRECIOUS
DON'T ABUSE IT
DON'T KINK IT
CUT OUT BAD SPOTS
they are dangerous, and often leak
RUN
USE SAFE HOSE MENDERS
RIGHT
WRONG
USE THE AIR YOU NEED
BUT DON'T WASTE IT!
DON'T use air in place of a broom
DON'T clear your clothes or hair—it's dangerous and wasteful
WATCH for and report leaks
CLOSE the Service valve at the end of shift or when not using air
USE AUTOMATIC BLOW GUNS
LEAKS AND WASTE LOWER AIR PRESSURE and SLOW PRODUCTION
Ingersoll-Rand
AIR LEAKS
SLOW DOWN PRODUCTION
USE THE AIR YOU NEED BUT
DON'T WASTE IT
If it leaks-tell your foreman
Ingersoll-Rand

To help you wage war on leaky valves, hose couplings, fittings, etc., we have prepared a series of easy-to-read posters for use on your bulletin boards.

Air leaks cause a serious pressure drop and needless power waste. Wide use of these posters will, we believe, result in the prompt reporting of any leaks that exist around your plant.

You may obtain as many copies as you need by getting in touch with the nearest office of Ingersoll-Rand Company.

Ingersoll-Rand Co.

Please send us the Posters on air leaks.

We can use ..... sets.

NAME OF COMPANY .....

ADDRESS .....

CITY ..... STATE .....

MY NAME ..... TITLE OR DEPT. .....

Ingersoll-Rand 14-310

11 BROADWAY, NEW YORK CITY

Atlanta					San Francisco
Birmingham	Cincinnati	Duluth	Knoxville	Philadelphia	Scranton
Boston	Cleveland	El Paso	Las Angeles	Picher	Seattle
Buffalo	Dallas	Hartford	Newark	Pittsburgh	St. Louis
Butte	Denver	Houston	New Orleans	Pottsville	Tulsa
Chicago	Detroit	Kansas City	New York	Salt Lake City	Washington

Now SEAL both OIL and WATER

NEW JOHN CRANE Insoluble PLASTIC LEAD SEAL FOR Heavy duty

PIPE-LINE, REFINERY, MARINE, POWER, CHEMICAL, AVIATION, INDUSTRIAL USES

Temperatures to 600° F. . . . Pressures to 4000 pounds per sq. in.

One "easy-spread" application and your sealing job is done—for sure, for years! John Crane new lead seal is plastic: will not set or seize nor harden under temperature extremes. Joints may be broken after years of service and remade without scraping. Protects threads, eliminates corrosion. Prevents scoring and galling. Adjusts to all clearances. May be applied to cork, paper, asbestos, copper, aluminum, lead, steel . . . John Crane Insoluble Plastic Lead Seal is a scientific laboratory formula made from pulverized metallic lead carried in a special vehicle: smooth, easy-spreading, fast-flowing. It is chemically pure: no red lead, clay filler or dope. An insoluble lubricant as well as a seal . . . Send for prices, sample and literature. Packed in 1, 3 and 5 pounds ready for use.

SERVICES: Oil, gasoline, kerosene, benzol, propane, butane, bottled gases, steam, water, hydrocarbons, aqueous solutions, ammonia, CO_2, toxic and inflammable gases, lutings in plugs.

EQUIPMENT: Threaded joints, flanges and gaskets, nuts, caps, valves, plug valve stems and seats, safety fuse plugs, screwed fittings, pumps, cylinder heads, boilers, compressors, stills, tanks, towers, gas stoves, etc., etc.

CRANE PACKING COMPANY, 1800 CUYLER AVENUE, CHICAGO

Branches: Baltimore, Boston, Buffalo, Cleveland, Dallas, Detroit, Houston, Los Angeles, New Orleans, New York, Philadelphia, Pittsburgh, St. Louis, San Francisco, Tulsa

Crane Packing Co., Ltd., Hamilton, Ontario, Canada

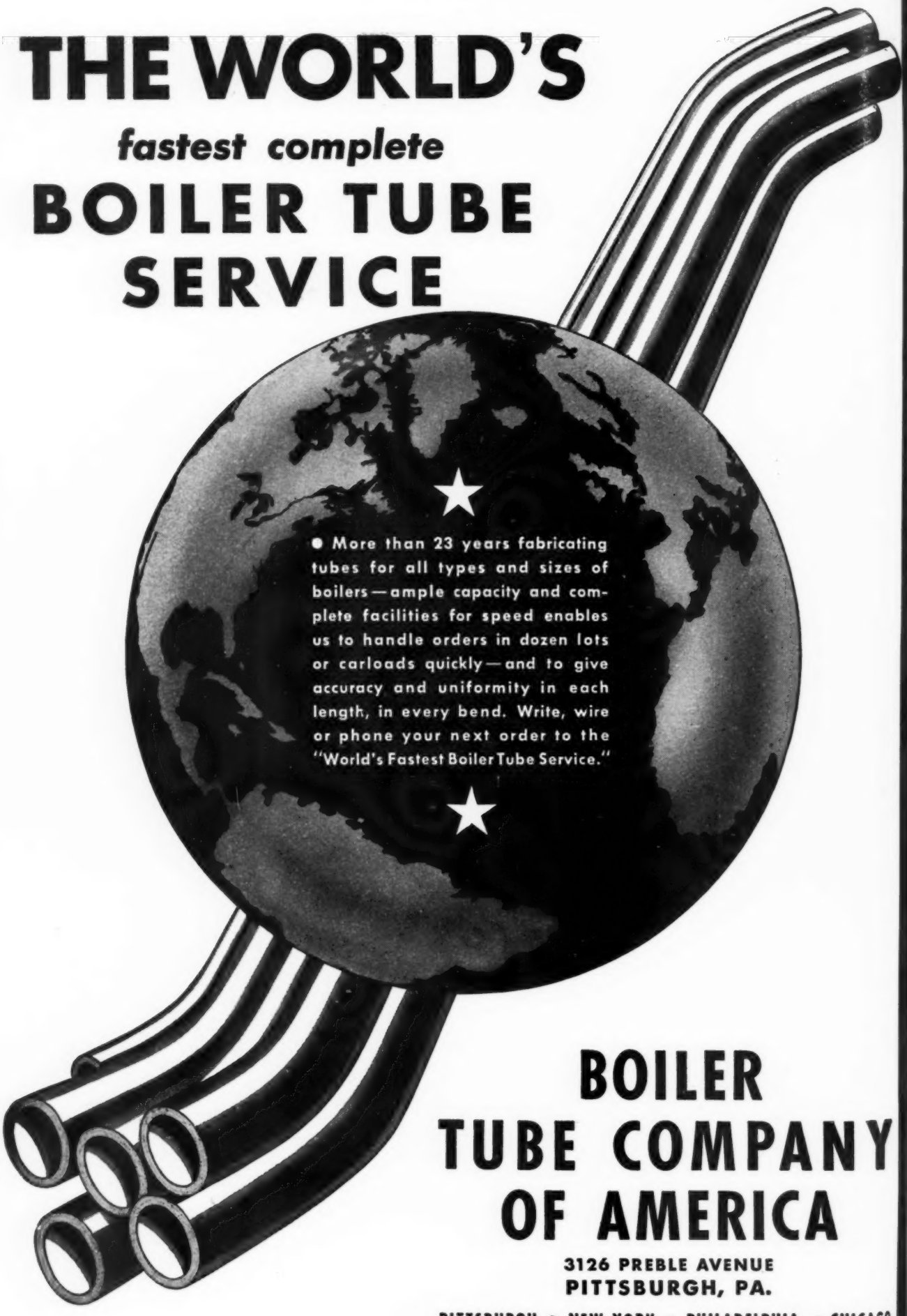
Branches: Montreal, Toronto, Vancouver

Extensively used by ✪ LEADING AIRPLANE BUILDERS

THE WORLD'S

fastest complete

BOILER TUBE SERVICE



● More than 23 years fabricating tubes for all types and sizes of boilers—ample capacity and complete facilities for speed enables us to handle orders in dozen lots or carloads quickly—and to give accuracy and uniformity in each length, in every bend. Write, wire or phone your next order to the "World's Fastest Boiler Tube Service."

BOILER TUBE COMPANY OF AMERICA

3126 PREBLE AVENUE
PITTSBURGH, PA.

PITTSBURGH • NEW YORK • PHILADELPHIA • CHICAGO
FRED S. RENAULD & CO. • LOS ANGELES

TO MARK PROGRESS

Controlled Quality...

The Ladish Drop Forge Co. symbolizes over 41 years of continuous service to American Industry. Forward-looking scientific experts, outstanding manufacturing facilities and exacting metallurgical control have been combined to produce unexcelled, controlled-quality forged steel flanges.

FITTINGS ARMY E NAVY DIVISION

LADISH DROP FORGE CO.

CUDAHY [MILWAUKEE SUBURB] WISCONSIN

THIS NEW CLUTCH

BRINGS THESE 12 ADVANTAGES

1. Simple in design and operation
2. Flexible control by air
3. No adjustments or oiling—low maintenance
4. Dampens vibration—absorbs shocks
5. Corrects misalignment automatically
6. Smooth starting—no jerks
7. Runs cooler—uniform pressure
8. Controls torque by air pressure
9. Greater capacity—more compact
10. Remote control by air valve
11. Replaces flexible couplings
12. Acts as clutch, slip-clutch, brake and coupling.

TO MANUFACTURERS OF

Heavy-duty Diesel drives, steel mills, presses, power shovels and cranes, oil-field equipment, compressors, hoists, motor generator drives, power take-offs—any heavy-duty service.

Many hundreds of AIRFLEX Clutches are in service in Diesel-powered Naval and Merchant Marine vessels.

You are invited to write for information to

FAWICK AIRFLEX COMPANY, INC.
9919 Clinton Road **Cleveland, Ohio**

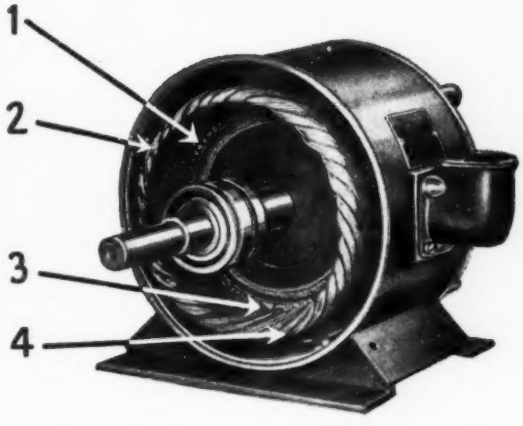
FAWICK *Airflex* CLUTCH

POWER CONTROLLED BY AIR

NEW INSULATION DEVELOPMENTS GIVE *Longer Life...*

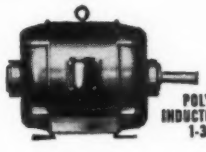
R&M Uni-Shell INTEGRAL HORSEPOWER MOTORS

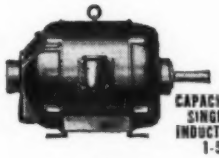
Important improvements in insulating technique, plus heat-testing of each design with thermocouples imbedded in the windings, insure cool operation with sharply increased life expectancy for every R & M Uni-Shell Motor. Four features of this insulation are indicated in the accompanying illustration. 1. Two layers of the highest-grade impregnated rag paper. 2. Wire coated with double-weight synthetic resin for greater insulating strength. 3. An *extra* sheet of impregnated paper placed between coils in slot, and a new method for holding and insulating end coils. 4. Entire winding assembly given several baked coats of synthetic resin-base varnish and covered with moisture-resistant synthetic resin and tung-oil sealer. . . . *By actual test we can say that the Uni-Shell Motor meets all temperature guarantees—inside and out.*

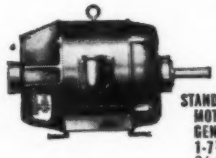


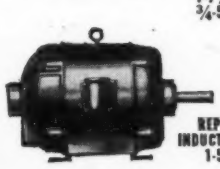
ONLY END HEADS CHANGE

Every dimension, from body to head fit, identical for all motor types.


POLYPHASE INDUCTION MOTOR 1-30 H. P.


CAPACITOR START SINGLE-PHASE INDUCTION MOTOR 1-5 H. P.


STANDARD D. C. MOTOR AND GENERATOR 1-7½ H. P. ¾-5 K. W.


REPULSION INDUCTION MOTOR 1-5 H. P.

ALL MOTOR TYPES INTERCHANGEABLE

All types in any one frame size in the new Uni-Shell motor line are interchangeable and similar in appearance. Every dimension and detail, from Uni-Shell motor body to head fit, is identical—only the end heads change. And in these cylindrical shells of steel are the finest, longest-lived motors that R & M has built in nearly 50 years of motor specialization. Advances in bearing quality and alignment, precision-balanced rotors, better insulation, cooler interior ventilation and many other features contribute to new high standards of efficiency and performance.

Whether you use motors as a part of your product, or only on the machines in your plant, the advantages of interchangeable motor types, together with the new motor efficiency, are easy to see. Write for your copy of our new 20-page illustrated book on R & M Uni-Shell Motors.

Mail Coupon FOR NEW 20-PAGE UNI-SHELL BOOKLET

ROBBINS & MYERS, INC., Springfield, Ohio

Gentlemen: Please send me your new 20-page booklet on Uni-Shell Motors.

Name.....*Position*.....

Company.....

Street Address.....

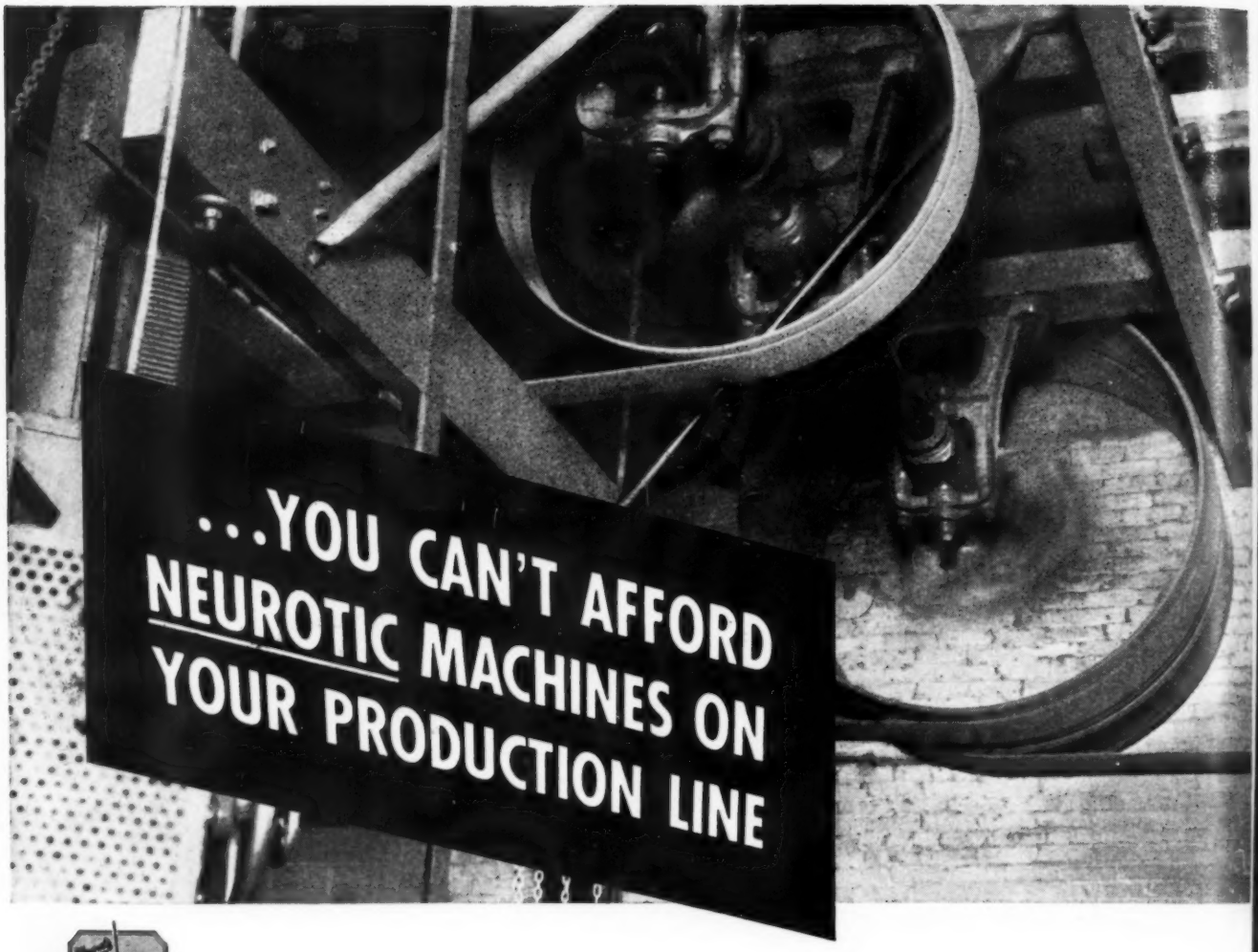
City.....*State*.....

I would ☐ would not ☐ like to talk to a representative. P4

ROBBINS & MYERS • INC.

MOTOR DIVISION, SPRINGFIELD, OHIO

HOISTS & CRANES • MACHINE DRIVES • FANS • MOYNO PUMPS • FOUNDED 1878



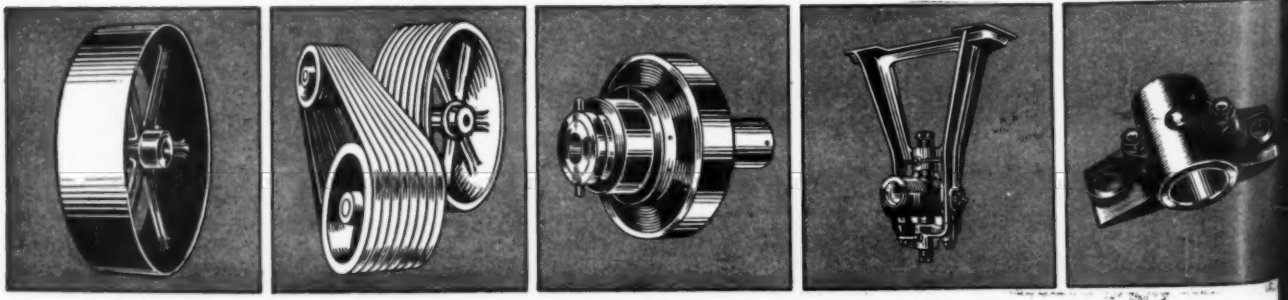
Canny engineers tell us there's a certain "indescribable something" about WOOD'S group drives which seems to say, on sight: "Here's machinery that's rarin' to pitch in and do a real job." And just such service, these engineers find, is the outstanding characteristic of *all* WOOD'S equipment. Consult the nearest WOOD'S distributor for help with ailing or neurotic production. He can aid you in keeping vital drives clear of power leakage, waste and breakdowns.

T. B. Wood's
SONS COMPANY
CHAMBERSBURG, PA.

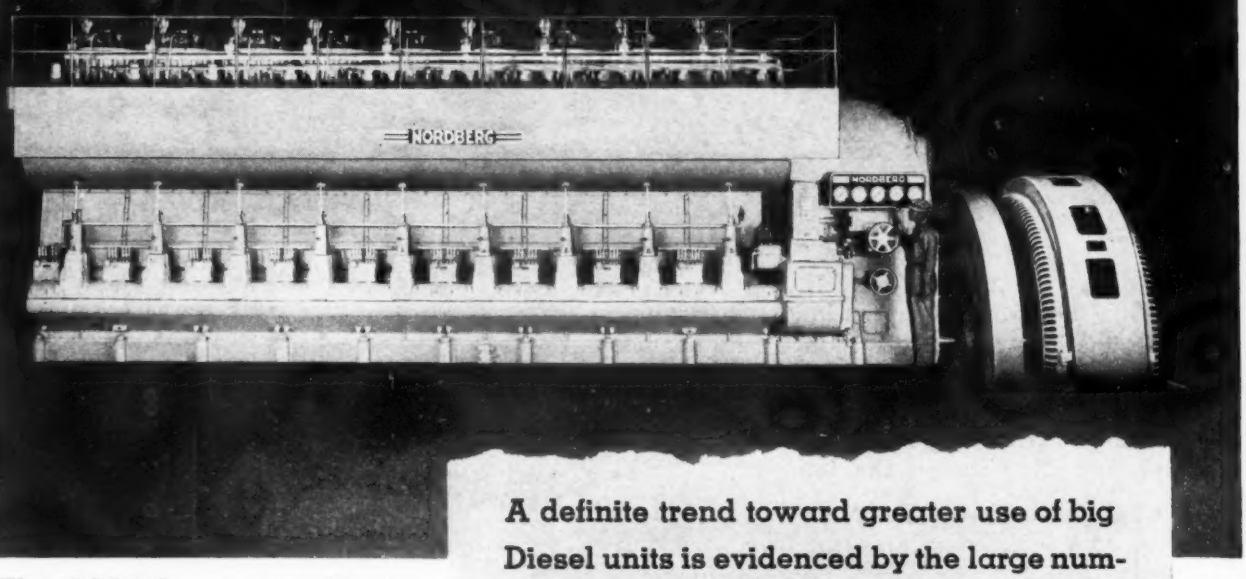
387-391 Atlantic Ave., Boston, Mass.
94 Plane Street, Newark, N. J.
425 First Avenue, Pittsburgh, Pa.

EVERYTHING IN TRANSMISSION

Bearings · Collars · Clutches · Couplings · Contactors · Hangers
Pillow Blocks · Pulleys · V-Belt Sheaves and Complete Drives



DIESEL POWER
for large capacity plants



This 3600 horsepower Nordberg Diesel engine is typical of the many of this size built for several large government plants and which supply power vital to our war effort.

A definite trend toward greater use of big Diesel units is evidenced by the large number of 3600 horsepower Nordberg Diesels recently installed. Some burn oil; some burn natural gas. In a single plant there is a total of 65,000 horsepower in Nordberg Diesel engines. This is the world's largest Diesel-engined power plant.

Back of these Nordberg Diesels is the experience of more than a quarter century in the building of engines of the larger powers. . . . This experience is available wherever Diesels of greater capacity are the best solution of the power problem.

NORDBERG MFG. CO., MILWAUKEE

NORDBERG MACHINERY

NORDBERG

DIESEL ENGINES

NORDBERG MACHINERY

THROUGHOUT American industry, Staynew Filters increase production, reduce maintenance. More guns, planes, tanks, ships, shells, trucks, and war materials of every kind are produced and moved faster to the fighting fronts because Staynew Filters are on the job.

At the fighting fronts, Staynew Filters add to the deadly efficiency of American weapons. Many a U. S. fighting man today owes his very life to the greater fire-power, speed, efficiency, or reliability of Staynew-equipped instruments of war.

After Victory, Staynew Filters will again help peacetime industry produce better, cheaper, faster.

Partial List of Staynew Filters and Their Direct Application to America's War Effort

STAYNEW INTAKE FILTERS help maintain maximum performance of tank, truck, and marine engines by preventing the intake of abrasive dust.

PROTECTOMOTOR FILTER CELL →

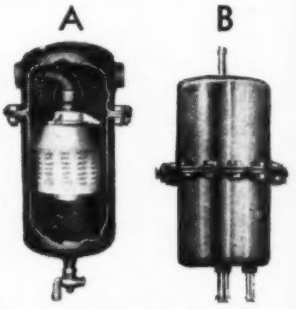
CIRCULAR TYPE AIR INTAKE FILTER

STAYNEW INTAKE FILTERS (Aircraft-type) help maintain a sufficient supply of clean air to aircraft carburetors and engines.

Representatives in Principal Cities

MODEL CPHLS LIQUID LINE FILTER

STAYNEW LIQUID LINE FILTERS add to long life and reliability of all types of internal combustion engines by removal of gritty particles and carbon from fuel and lubricating oils. These filters speed war production by removing foreign matter from coolant oils; they guarantee clean water in the field for photo-processing; they are capable of handling algae-bearing water.



A—Model CPH Oil Vapor Arrestor.

B—Model CP Aircraft-type Oil Vapor Arrestor.

STAYNEW OIL VAPOR ARRESTORS prevent oil from crankcase breathers reaching blades of engine turbo-chargers; also prevent oil from the discharge of rotary or other types of compressors damaging or fouling accessory apparatus and control mechanisms.

Automatic Type Ventilation Filter

STAYNEW FILTERS for building ventilation, including automatic and dry panel types, are contributing everywhere to the continuity of service of both men and machines.

BUILDING AIR-SUPPLY FILTER

Have You a Filter Problem?

The broad experience of Staynew engineers is proving invaluable in solving war industry problems. This experience, product of more than 22 years of exclusive filter manufacturing, is yours for the asking.

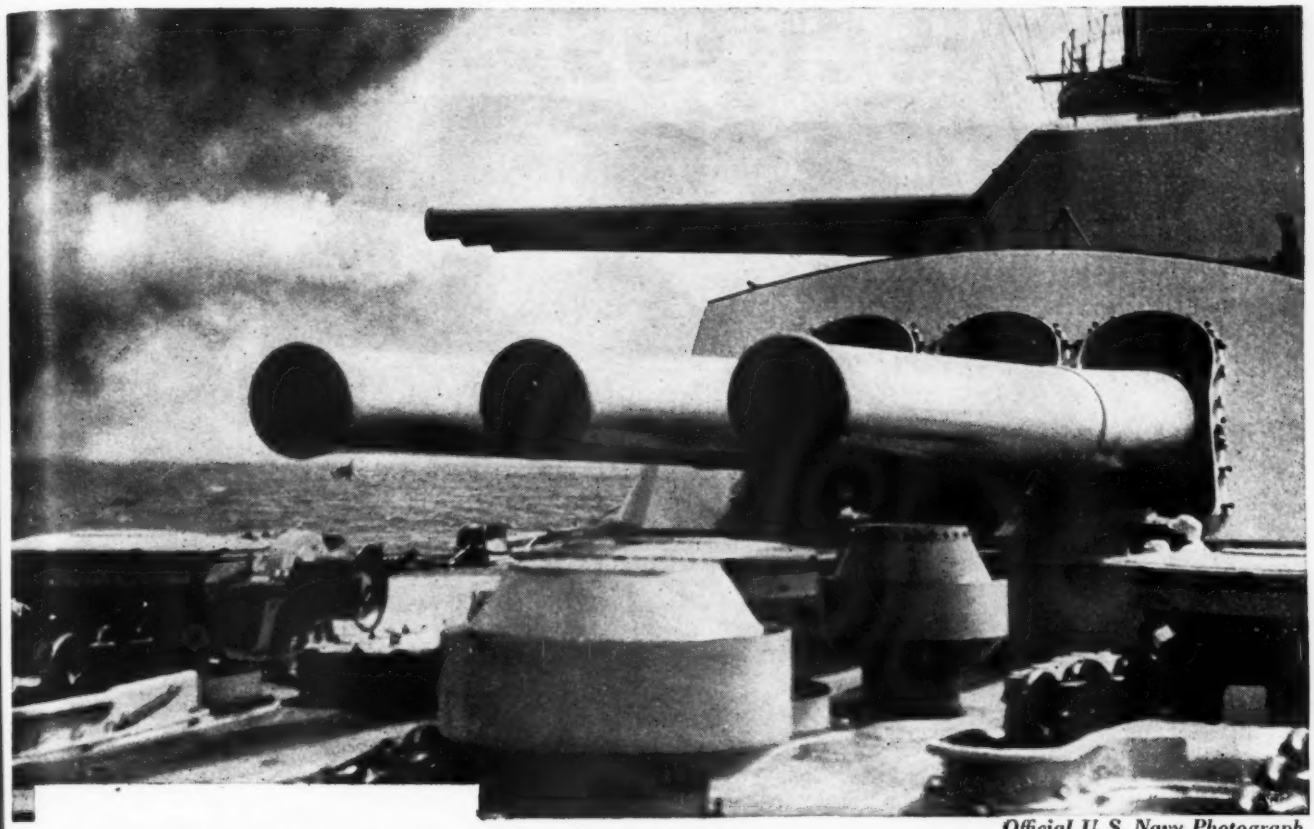
OVER ONE MILLION STAYNEW FILTERS PLACED IN SERVICE

STAYNEW FILTER CORP.

PROTECTOMOTOR AIR FILTERS

"Filter Headquarters"

23 FILTER PK., ROCHESTER, N.Y.

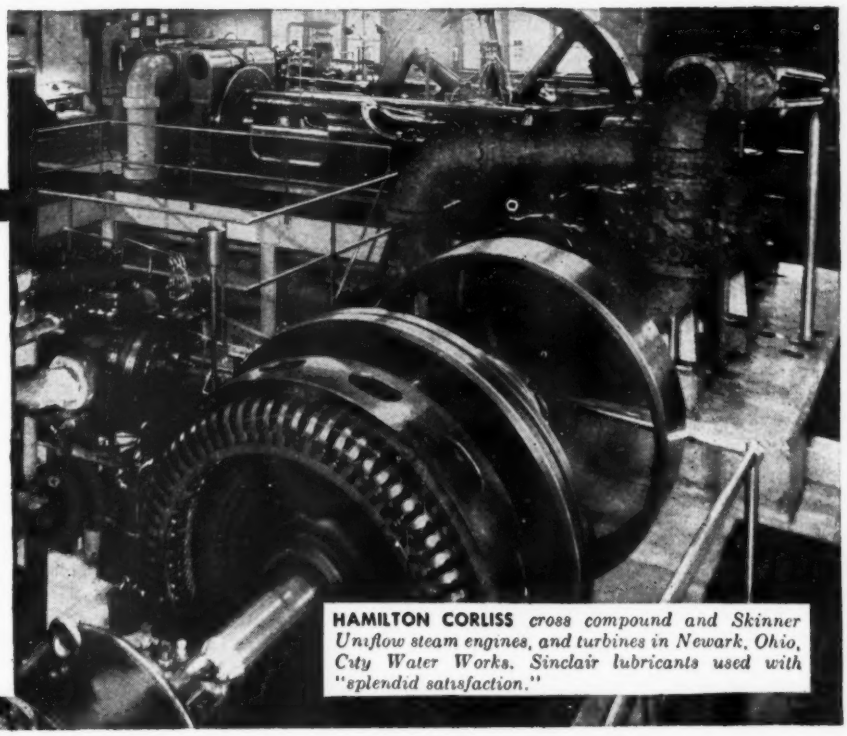


Official U. S. Navy Photograph

BIG PUSH ABROAD needs all-out support at home. To maintain full designed *STEAM* plant output use . . .

. . . SINCLAIR STEAM CYLINDER and VALVE OILS. These oils meet wet, dry, or superheated steam requirements, are easily separated for steam recovery . . . suit all engine designs and operating characteristics.

Write for "The Service Factor"—a free publication devoted to the solution of lubricating problems



HAMILTON CORLISS *cross compound and Skinner Uniflow steam engines, and turbines in Newark, Ohio, City Water Works. Sinclair lubricants used with "splendid satisfaction."*

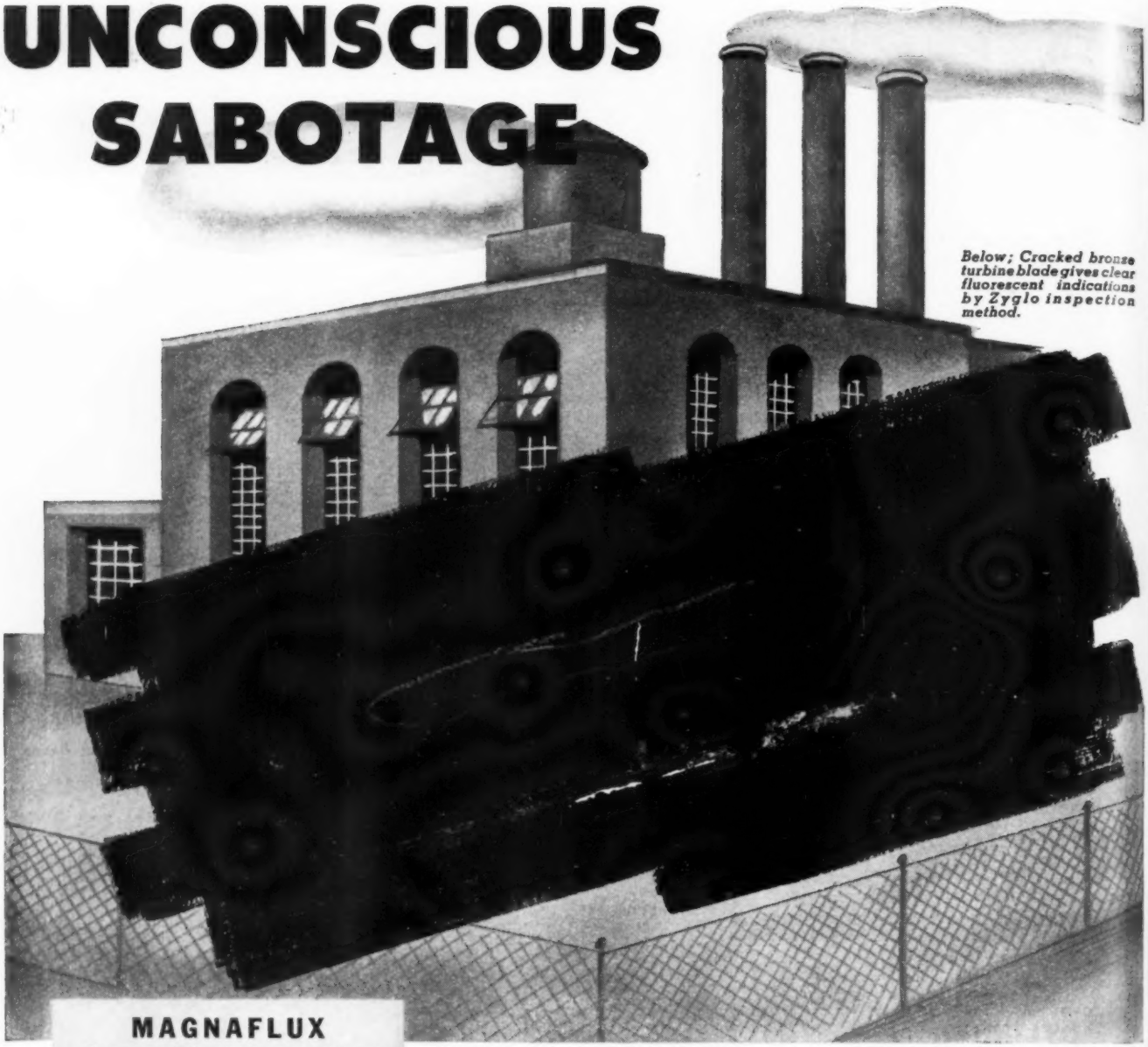
SINCLAIR INDUSTRIAL OILS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE NEAREST SINCLAIR OFFICE

SINCLAIR REFINING COMPANY (Inc.)

2540 West Cermak Road, Chicago • 10 West 51st Street, New York City • Rialto Bldg., Kansas City • 573 West Peachtree Street, Atlanta • Fair Building, Ft. Worth

UNCONSCIOUS SABOTAGE



Below; Cracked bronze turbine blade gives clear fluorescent indications by Zyglo inspection method.

MAGNAFLUX
Power Plant Inspection Service

3 METHODS

MAGNAFLUX
Magnetic Particle Inspection

MAGNAGLO
Fluorescent Magnetic Particle Inspection

ZYGLO
Fluorescent Non-Magnetic Inspection

Inspect . . . Detect . . . Protect Against It

Incurring damage to power plant equipment *by not being able to detect the flaws* is certainly not a guilty act. But damage which develops from undetected fatigue cracks nevertheless ranks with sabotage in today's world crisis—stops an entire plant, often many plants.

The improved inspection methods developed by Magnaflux Corporation now enable power plants to forestall failure in a double sense—not only at an earlier stage than other methods permit, but in a wider range of equipment even than Magnaflux* Methods permitted formerly. Non-magnetic materials can now be inspected as well as magnetic, and both types of inspection can be performed in dark inaccessible places with better practical results.

Three methods—Magnaflux, Magnaglo and Zyglo—now in daily use in other industries have been combined as Magnaflux Power Plant Inspection Service. Through Magnaflux Corporation's branches and field representatives, a service contract can be made for periodic inspections at a rate based on horsepower and types of equipment. Scheduling of service to coincide with tear-down and overhaul work can be arranged.

All interested companies are urged to write for the fullest details of the service now.

*Magnaflux—the Trade Name of the Magnaflux Corporation applied to its equipment, materials and methods for magnetic particle inspection.

MAGNAFLUX CORPORATION
5920 Northwest Highway, Chicago
NEW YORK • DETROIT • DALLAS • LOS ANGELES

Buy Quality and AVOID BREAKDOWNS

The two-diamond emblem of QUALITY on all Watson-Stillman forged steel fittings and valves protects you. These are days of high-production schedules when reliable equipment is important to the War Effort. A breakdown in the fast-moving production line, where each machine and each component part must be able to stand the extra strain, may mean the loss of man-hours that can never be recovered.

The years of engineering experience that go with every Watson-Stillman product assure continued confidence on the part of users. You avoid breakdowns when you buy ONLY the best. The Watson-Stillman Co., Roselle, N. J.

For authoritative, factual data write for Watson-Stillman's fact-packed bulletins. They show clearly what W-S equipment to use and why and how.

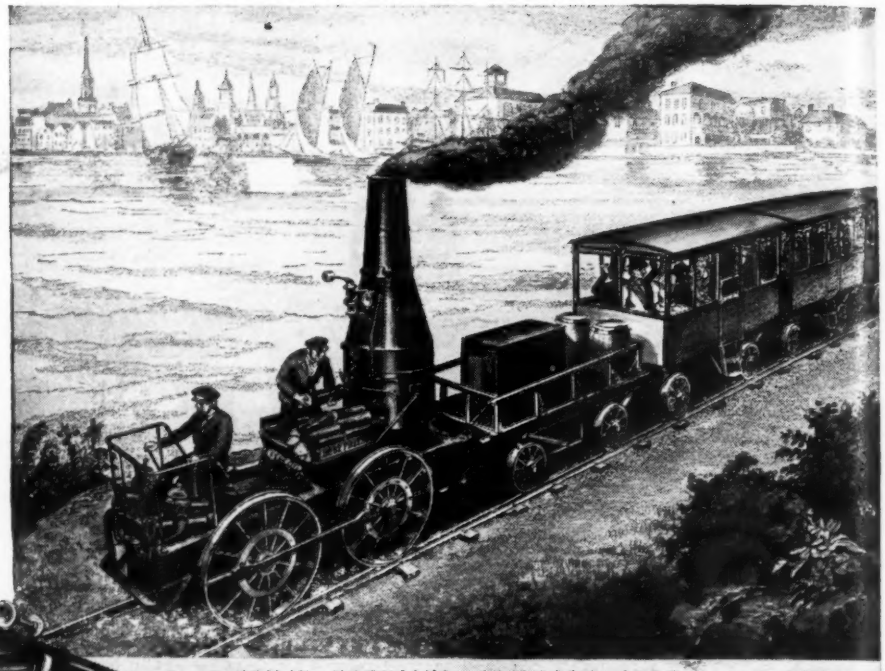
WATSON-STILLMAN

Distributor Products Division

Engineers and Manufacturers of Forged Steel Fittings, Valves, Wire Rope Shears, Pumps, Jacks, and Hydraulic Machinery and Equipment

For Victory ★★★ Let's all be Scrappers

THERE'S SOMETHING NEW IN THE PICTURE



The "Best Friend of Charleston" was the first locomotive entirely built in this country—for the South Carolina Railroad, now part of the Southern Railway System.

OUT of every war has grown a new era in transportation. This one is no exception. The pattern of that new era had been set, even before this war, by the General Motors Diesel Locomotive. And its Leadership in the Peace to come is forecast in the way this locomotive is today meeting the challenges of war.

Daily movement of a staggering quantity of oil from New Orleans to the Eastern States is the No. 1 war job of the Southern Railway. The Southern assigns its fleet of General Motors Diesel freight locomotives as the key motive power to expedite this important flow.

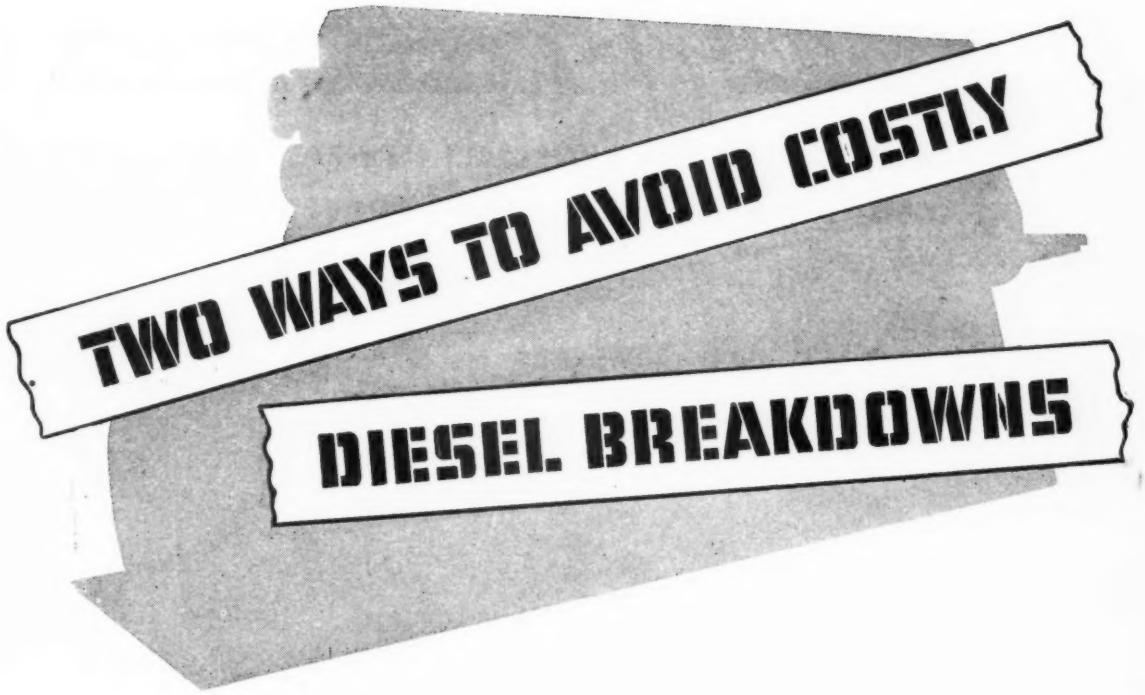
There will be something new in the farm and industrial pictures too. For there will be GM Diesels ready to serve wherever America needs power.

GM
GENERAL MOTORS
DIESEL POWER

LOCOMOTIVES.....ELECTRO-MOTIVE DIVISION, La Grange, Ill.

ENGINES..150 to 2000 H.P...CLEVELAND DIESEL ENGINE DIVISION, Cleveland, Ohio

ENGINES.....15 to 250 H.P.....DETROIT DIESEL ENGINE DIVISION, Detroit, Mich.



1. KNOW WHAT YOUR DIESEL NEEDS!

Get the expert advice of a Cities Service Diesel Lubrication engineer. (No cost or obligation.) He'll study the needs and problems of your particular job, and work out a plan to reduce breakdowns and costly repairs—and keep your Diesels running at peak efficiency.

In his work, he'll use the Industrial Heat Prover (exclusive with Cities Service), an instrument which eliminates guess-work in analyzing combustion problems.

2. USE SERVICE-PROVED LUBRICANTS!

Cities Service will supply you with *precision-perfect* lubricants which have been long tested under the tough demands of all-out operation—and have proved powerful allies in achieving steady, flawless, economical operation. For full information about the proper type and grade of Cities Service Diesel lubricant required by your equipment, get in touch with your nearest Cities Service Office.

An informative booklet on "Diesel Engine Lubrication" has been prepared by our engineering staff and is available to users of Diesel engine oils *without charge*. Write Room 1650, Sixty Wall Tower, District 5, New York, for your copy today.

OIL IS AMMUNITION—USE IT WISELY!

CITIES SERVICE OIL COMPANY
NEW YORK · CHICAGO

IN THE SOUTH
ARKANSAS FUEL OIL COMPANY
SHREVEPORT, LA.

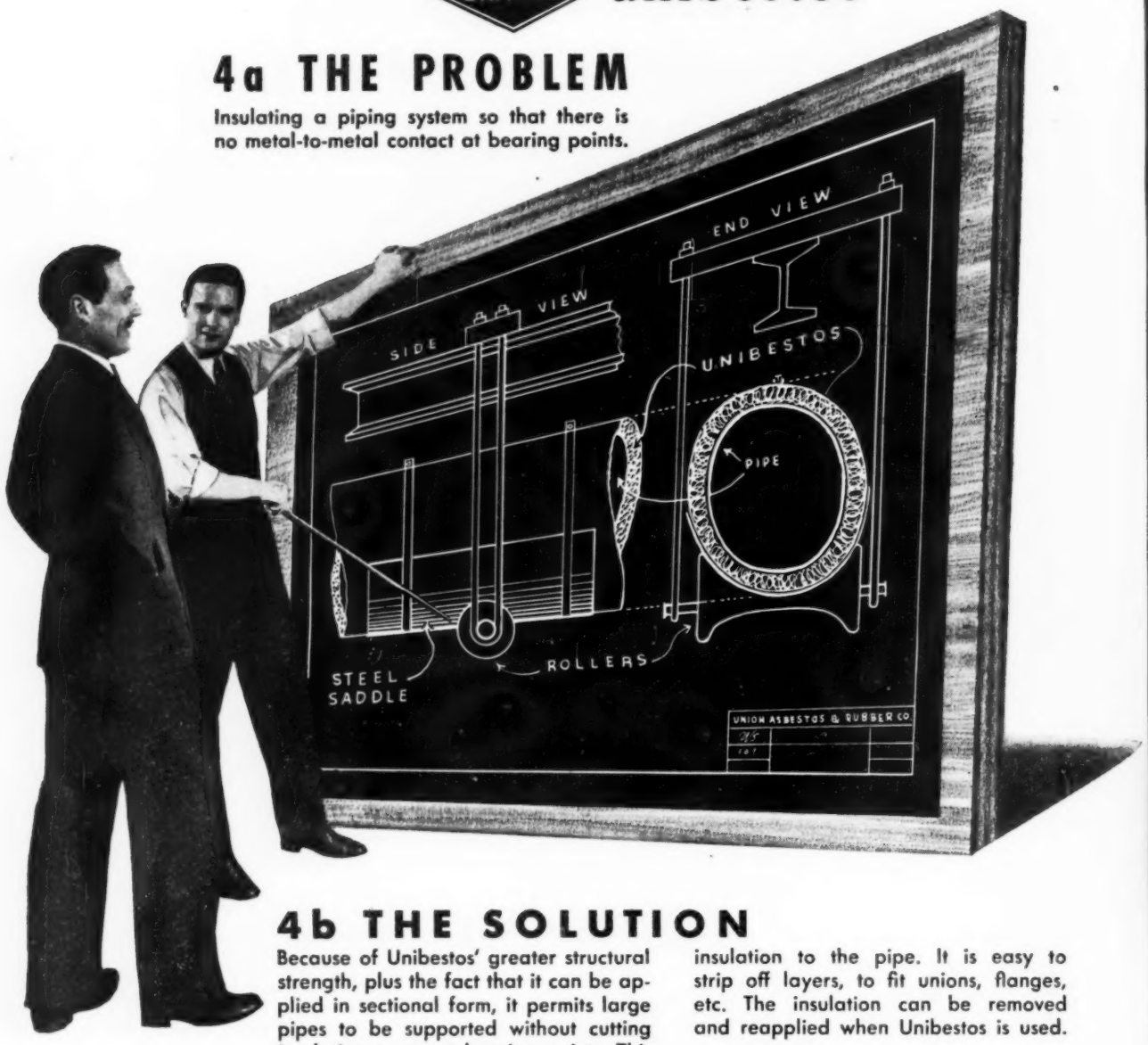
This is the 4TH in a series of messages

DEALING WITH THE PROBLEMS IN HEAT INSULATION FACED BY ENGINEERS AND SOLVED BY USING

UNARCO unibestos

4a THE PROBLEM

Insulating a piping system so that there is no metal-to-metal contact at bearing points.



4b THE SOLUTION

Because of Unibestos' greater structural strength, plus the fact that it can be applied in sectional form, it permits large pipes to be supported without cutting insulation away at bearing points. This is done by laying a steel saddle under the insulation at points where the pipe is supported by rollers, tie rods or other means. This makes it unnecessary to cut away the insulation or to use metal supports that penetrate through the insulation to the pipe. It is easy to strip off layers, to fit unions, flanges, etc. The insulation can be removed and reapplied when Unibestos is used.

unibestos is available in Standard material, for temperatures up to 750°; Super, with a temperature limit of 1200°; Combination, with a temperature limit of 1200°. These temperature limits permit the use of one material at maximum efficiency for a wide range of purposes. Unibestos is available in half sections up to 30" pipe diameter and from 32" to 60" in quadrants from ¾" to 5" in thickness. Standard and Super are available in single layer construction with provision for expansion in piping, where required.

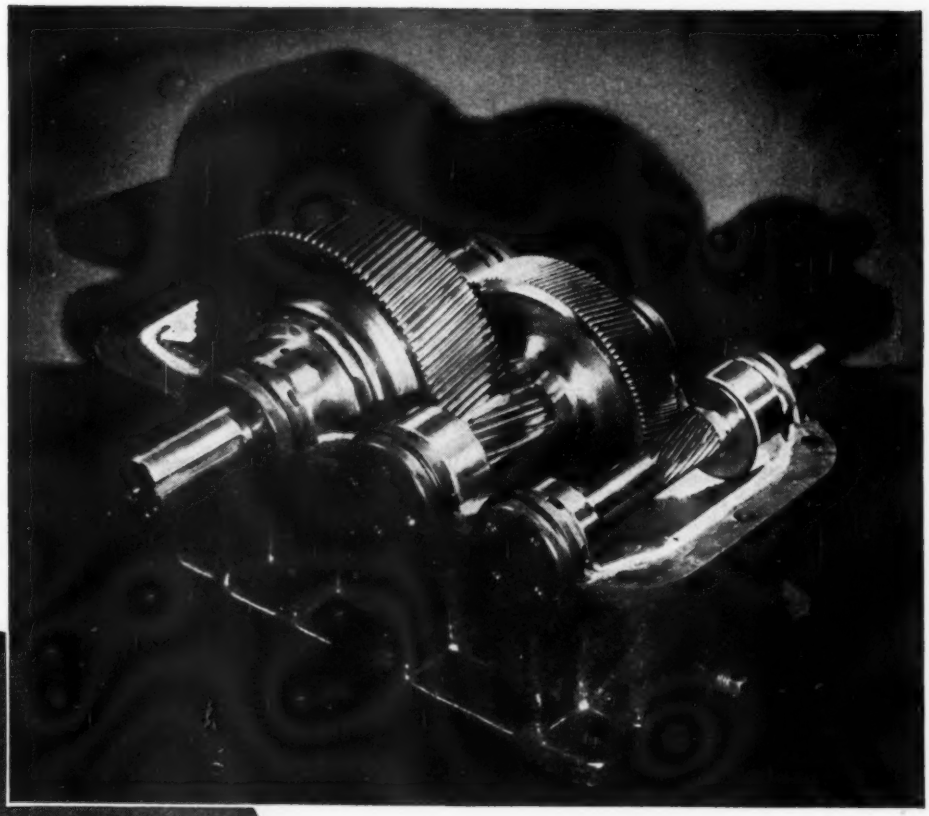
ARMY E ARMY E NAVY

TWO ARMY-NAVY "E" AWARDS FOR EXCELLENCE IN WAR PRODUCTION ONE TO THE CICERO, ILLINOIS PLANT, ONE TO THE PATERSON, N. J. PLANT

UNION ASBESTOS & RUBBER CO.

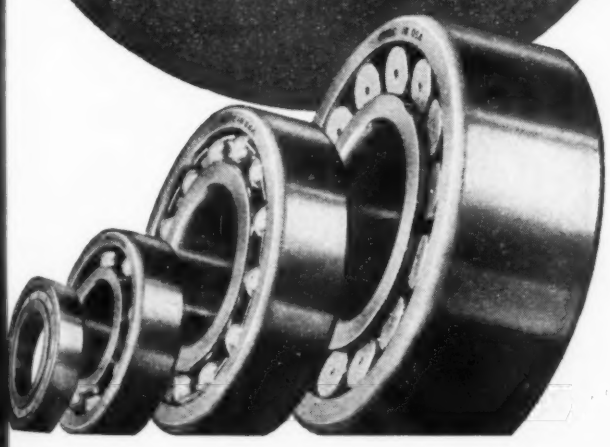
GENERAL OFFICES: 1821 SOUTH 54TH AVENUE, CICERO, ILLINOIS • NEW YORK • SAN FRANCISCO • PATERSON, N. J.

From 2.87-1 TO 96.2-1
ON SKF BALL BEARINGS



• *Built by*
FOOTE BROS.
GEAR & MACHINE CORP.

SKF
Ball and Roller
BEARINGS



In the handling of heavy shock or pulsating loads with high efficiency, this IXL "Titan" Helical Gear Reducer is doing its bit in the War Effort. And it's doing it smoothly and continuously on SKF Bearings. Made in sizes up to 300 h.p. in ratios from 2.87 to 1 up to 96.2 to 1, this reducer imposes exacting requirements upon SKF Bearings. Rolling response must be instantaneous. That SKF's do this well has made them the favorites of engineers everywhere.

5329

SKF INDUSTRIES, INC., PHILA., PA.

Rubber Planter OF 1943

The man who grows America's rubber today runs a Cooper-Bessemer compressor. With the aid of this big engine he handles gases for reforming them into new compounds—such as butadiene for Buna S, isobutylene for Butyl, acetylene for Neoprene, and ethylene for Thiokol and Koroseal.

Outstanding among compressors is the Type G-MV—rugged, dependable, long-lived—powered by a compact, efficient, V-angle engine, either gas or diesel-driven. It is built in 400, 600, 800 and 1,000 hp sizes. Compressor cylinders are available for extremely high pressures. It is the key instrument of this war's synthesis industries.

Cooper-Bessemer has built hundreds of thousands of compressor horsepower for war since Pearl Harbor—and after Victory will continue to serve the process industries with compressors to win the peace.

The Cooper-Bessemer Corporation

MOUNT VERNON, OHIO GROVE CITY, PENNA.

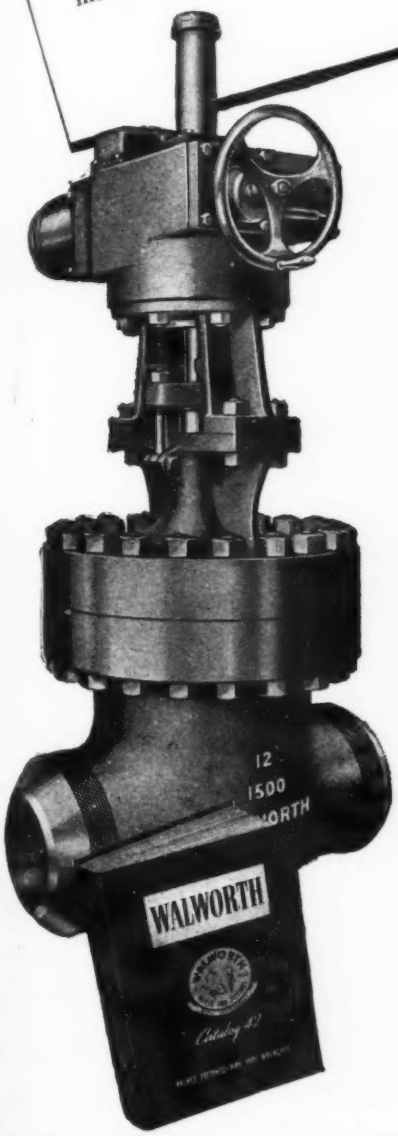
New York Washington Tulsa Dallas St. Louis Houston Los Angeles Seattle Shreveport

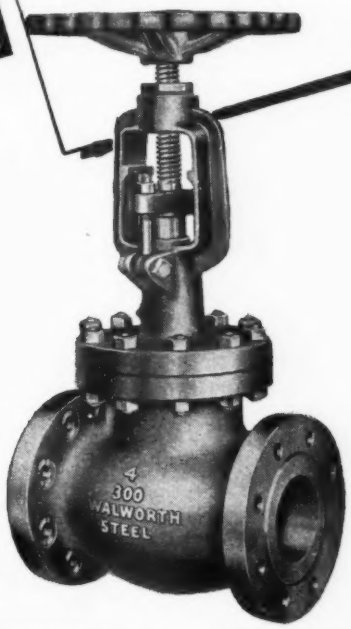
FIT THE VALVE TO THE SERVICE

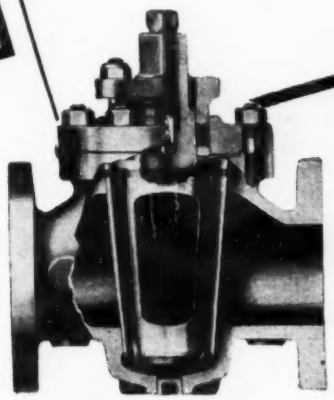
WALWORTH STEEL GATE VALVES can be furnished with welding ends, screwed ends, or flanged ends. Sizes from 2" to 24" inclusive. For hand operation, air or gas motor operation, or electric motor operation.

WALWORTH STEEL GLOBE VALVES can be furnished with welding ends, screwed ends, or flanged ends. Sizes from 2" to 8" inclusive. For hand operation, air or gas motor operation, or electric motor operation.

WALWORTH LUBRICATED PLUG VALVES are made in sizes from ½" to 24" inclusive, for pressures from vacuum to 5000 psi.







YOU CAN CHOOSE A WALWORTH *Steel* VALVE

engineered to your particular service

Be sure that every valve fits the service for which it is selected — and fits exactly. In the Walworth line there's a type for every job, engineered so as to assure maximum economy and worry-free performance. Each Walworth Valve has all the characteristics required for its special service.

For instance, Walworth makes a complete line of cast steel valves. They can be furnished in both gate and globe types with welding ends, screwed ends, or flanged ends. Heavy walls give enduring strength. Deep stuffing boxes eliminate troublesome leakage. Streamlined ports decrease pressure drop. These Walworth Valves have what it takes in every detail of design, metallurgy, and construction to lick your toughest jobs.

For the "difficult" fluids the answer is often found in a Walworth Lubricated Plug Valve. It opens or closes with but one-quarter turn of the valve handle, and a positive tight shut-off is assured. It's easy to operate and remains completely sealed against leakage in both the open and closed positions.

For economy's sake, be sure to "fit the valve to the service."

To help you "fit the valve to the service" you'll find pertinent information on Walworth's complete line of valves, fittings, pipe, and pipe wrenches in the new Walworth Catalog 42. Included are 78 pages of practical engineering data that simplify valve selection and make piping layouts easier. Write, on business stationery, for your free copy. Address: Walworth Company, 60 East 42nd Street, New York, N. Y. Department 75.

ARMY E ARMY E NAVY

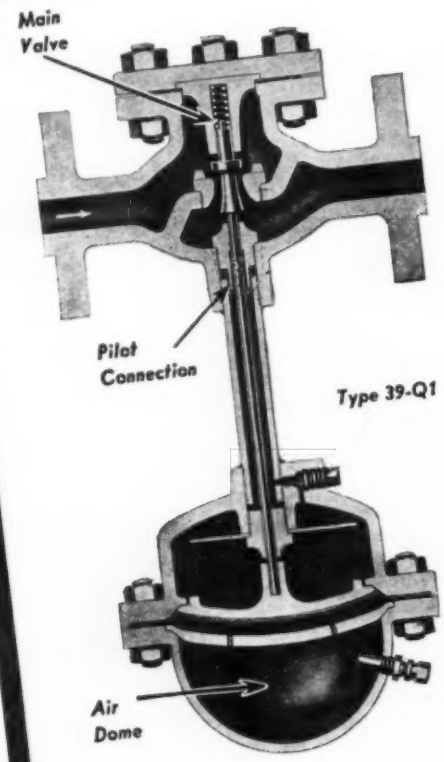
BOSTON WORKS
KEWANEE WORKS

WALWORTH
valves AND fittings

WALWORTH ★ VALVES AND FITTINGS ★ ESTABLISHED 1842

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

Simple, isn't it?

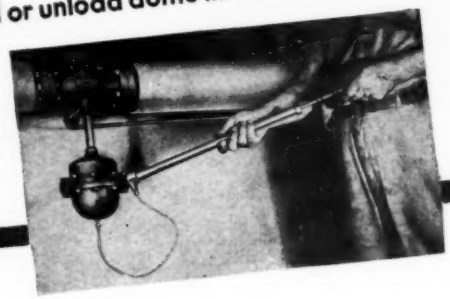


For initial steam pressures up to 2500 pounds—Delivery pressures up to 1200 pounds—Temperatures up to 1000° F.

The Foster 39-Q1 Pressure Reducing Regulator Gives You Accuracy . . . Easy Setting . . . Low Maintenance

Here's Why...

- Single seated for dead-end service Valve closes in direction of flow
- No springs . . . no weights
- No stuffing box . . . no packing
- Few moving parts
- Long stem . . . low heat transfer
- Large diaphragm area . . . sensitive regulation
- Easy to load or unload dome like an automobile tire



Dome being loaded — at the valve — by hand pump.

In this latest development in pressure reducing regulators, valve action is controlled by the diaphragm of the air-loaded dome instead of the usual springs or weights. Response to slight change in differential pressure is quick because of large area of diaphragm, resulting in more accurate regulation. This regulator will handle greater reductions than have been possible, heretofore, in a single stage. Higher or lower delivery pressure is obtained by changing the pressure in the dome. It's as simple as that! There are many other types of Foster Regulators to solve your every regulation problem—and Foster engineers will gladly work with you—without obligation. Complete handbook on Reducing Valves, Temperature Regulators, Pump Governors and Sirens—with eight sections of useful engineering data will be sent if the request is made on company letterhead. Simply ask for Catalog 70.

FOSTER ENGINEERING Company

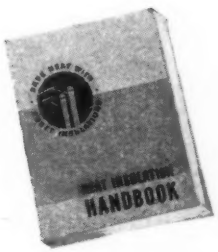
PRESSURE REGULATORS...RELIEF AND BACK PRESSURE VALVES...AUTOMATIC STOP AND CHECK VALVES...ALTITUDE VALVES...DAMPER REGULATORS...FAN ENGINE REGULATORS... PUMP GOVERNORS...TEMPERATURE REGULATORS...LIQUID LEVEL CONTROLLERS...FLOAT AND LEVER BALANCED VALVES...NON-RETURN AND TRIPLE DUTY VALVES...VACUUM REGULATORS OR BREAKERS...SIGHT FLOW BOXES...STRAINERS...SAFETY VALVES...SIRENS

106 MONROE STREET • NEWARK, N. J.

7-FE-1

FOR DRUMHEADS . . . SKINS

. . . and for INSULATION *85% Magnesia*



EHRET'S 85% MAGNESIA and many other Ehret heat insulating materials are fully treated, both as to selection and application, in the 176-page Heat Insulation Handbook. It will be furnished, without obligation, to those interested in getting the most from their thermal insulations. Write today for your copy.

Ever since the primitive drums of the African jungles first beat out their signal messages, a stretched skin has invariably been the basic sounding medium. Time has proved this to be the *one* material for the purpose.

★ ★ ★

And in the field of pipe and boiler insulations, there is *one* material which, for more than half a century, has also proved that it can "take a beating"—85% MAGNESIA. Countless service records in practically every branch of industry bear indisputable testimony to 85% Magnesia's efficiency, long life and economy.

Industrial insulating materials cost but a small fraction of the money they save. Make sure of the permanence of your insulation investment by continuing to specify Ehret's 85% Magnesia.

EHRET MAGNESIA *Ehret* **MANUFACTURING CO.**
VALLEY FORGE, PENNA.

. . . THERE IS AN *EHRET* DISTRIBUTOR OR CONTRACTOR IN EVERY INDUSTRIAL AREA

ICARUS ATTACK painted by W. Goodby Lawrence, U. S. C. G. R.

When the U. S. Coast Guard Cutter *Icarus* sank a Nazi Sub (or in Navyese "scratched one hearse") capturing thirty three officers and men . . . Briggs Clarifiers were delivering clean, pure, oil to her twin propulsion engines . . . Again, Briggs products had rendered efficient performance in action at sea. However, this is only one story.

In every branch of the service . . . in every theatre of war . . . Briggs Clarifiers are doing an oil filtering job. Engines, with this extra protection, are operating under extreme conditions without a hitch.

When human lives depend upon unfailing engine performance every precaution must be taken to guarantee continuous operation. Briggs Clarifiers have become a vital part of war-time engines the world over.

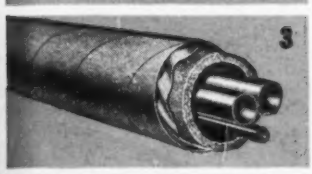
Into every Briggs Clarifier goes the knowledge, engineering, and design resulting from years of research by Briggs Engineers . . . research which has developed a filtering medium capable of assuring outstanding performance of all types of engines—in every field.

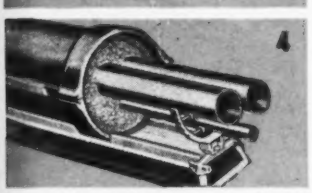
BRIGGS Clarifier CO.

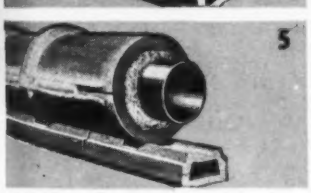
1339 WISCONSIN AVE. WASHINGTON, D. C.

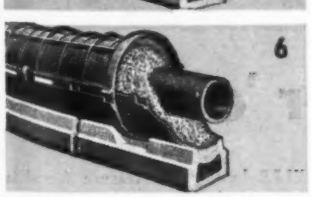
Ric-wil offers conduit for every need— the most complete line, meeting all conditions of service and cost

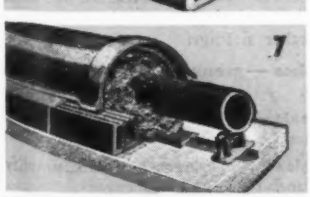
There is a Ric-wiL insulated conduit system engineered to your specific needs—the transmission of steam, hot water, oil, hot or refrigerated process liquids—providing heat transfer with the lowest possible loss.

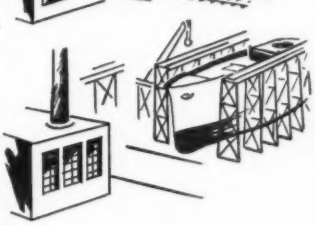


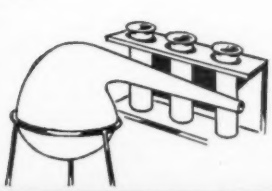












1. RIC-WIL INSULATED PIPE UNIT—SINGLE PIPE SYSTEM

Prefabricated complete units—pipe as specified, thoroughly insulated, in helical corrugated conduit, coated and wrapped with asphalt saturated asbestos felt. 21-ft. lengths for speedy installation. For underground or overhead systems.

2. RIC-WIL INSULATED PIPE UNIT—MULTIPLE PIPE SYSTEM

Any specified combination of pipes in prefabricated conduit—insulated and protected the same as the single pipe system. Any or all of the pipe lines may be specially insulated to meet job requirements.

3. RIC-WIL INSULATED PIPE UNIT—FOR PROCESS LIQUIDS

An adaptation of the multiple system used where a steam or hot water line heats fluids in other lines. Pipes are insulated from the exterior but not from each other. Sizes and specifications as required—conduit same as for other insulated pipe units.

4. RIC-WIL STANDARD TILE CONDUIT—TYPE F

Vitrified glazed A. S. T. M. Standard Tile Housing—acid and waterproof—with foundation type base drain supporting weight of piping through correctly engineered pipe supports. Positive locked-in-place cement seals on sides and ends. For single or multiple pipes.

5. RIC-WIL SUPER TILE CONDUIT—TYPE F

Same advantages as Standard Tile but with walls approximately double thick for strength under heavy traffic or where overhead load is above normal. Will support concentrated static load of 6 tons per wheel under actual installation conditions. Base drain of extra-heavy tile.

6. RIC-WIL CAST IRON CONDUIT—TYPE F

Heavy reinforced cast iron conduit for use where underground pipe lines run close to or under railroad tracks. Durable, water-tight and vibration-proof. Positive locked-in-place cement seals on sides and ends with metal clamps for extra tightness.

7. RIC-WIL TILE CONDUIT—UNIVERSAL TYPE

Where installation conditions dictate the use of a concrete pad Ric-WiL Universal Tile is recommended. Side walls are double-cell vitrified trapezoidal block design. Arch may be Standard Tile, Super-Tile, or Cast Iron.

8. RIC-WIL TILE CONDUIT—TYPE DA

For oil or process liquids where conduit must be insulated but individual lines are not insulated from one another. Insulation is a diatomaceous earth lining, moulded and keyed to inside of tile. May also be used (Type DF) with fibre insulation for steam heat, power and superheated steam. Applicable to Standard, Super-Tile and Cast Iron.

Ric-wiL accessories are available in all type systems; standard and special fittings, factory fabricated or field fabricated expansion devices, alignment guides, and anchors. Descriptive bulletins on request.

GET THE ORIGINAL—SPECIFY RIC-WIL

RIC-WIL INSULATED CONDUIT SYSTEMS
THE RIC-WIL COMPANY · CLEVELAND, OHIO
AGENTS IN PRINCIPAL CITIES

"I like the way they engineer 'em"

HE DESIGNS PIPING . . . One of the most important parts of his job is making dead sure that the strength of every part of the system is equal to the strain imposed on it.

WeldELLS and other Taylor Forge Welding fittings* are in key with this:

—They have extra reinforcement of the inner wall where stress is greatest.

—They have full pipe thickness at the outer wall.

—They have tangents that keep the weld away from the zone of greatest stress.

—They meet every condition; are made in a wider range of sizes, materials and thicknesses than any other welding fittings.

In short, they are the fitting that gives the engineer *everything* he wants—at no extra cost.

• The list of Taylor Forge's contributions to the war effort only begins with WeldELLS. Every Taylor Forge product is playing a vital part. One of many examples is Forged Steel Welding Nozzles, essential to hundreds of transports and fighting ships.

TAYLOR FORGE & PIPE WORKS
General Offices & Works:
Chicago, P. O. Box 485
New York Office: 50 Church St.
Philadelphia Office: Broad St. Station Bldg.

* WeldELLS and many other Taylor Forge products are produced in Byers Genuine Wrought Iron.

★ WeldELLS have every feature found in any welding fitting; some features found in no other fittings:

• **Seamless** — greater strength and uniformity.

• **Tangents** — keep weld away from zone of highest stress — simplify lining up.

• **Precision quarter-marked ends** — simplify layout and help insure accuracy.

• **Selective reinforcement** — provides uniform strength.

• **Permanent and complete identification marking** — saves time and eliminates errors in shop and field.

• **Wall thickness never less than specification minimum** — assures full strength and long life.

• **Machine tool beveled ends** — provides best welding surface and accurate bevel and land.

• **The most complete line of Welding Fittings and Forged Steel Flanges in the World** — insures complete service and undivided responsibility.

30 YEARS OF ENGINEERING *Service*

Thirty years ago when Detrick hung his first suspended arch he was pioneering in a field that was destined to have a very profound influence on the design of furnaces. As each new furnace problem presented itself Detrick offered a new development in suspended construction that proved its effectiveness in service. And today Detrick is designing for tomorrow's furnaces and process units.

The principles learned in this long concentration on the problem of heat enclosure have been brought together in a new 80-page book which is virtually a text book on the subject of Enclosing and Conserving Heat.

A Textbook on Suspended Arches and Walls

Every engineer will find this book a quick way to bring himself up to date on this subject. The story is told in pictures and charts, illustrations and photographs, and the text explains the constructions and the reasons back of them.

Under such headings as those listed below the principles learned from thirty years of study and practical experience are presented in a graphic way that every engineer will appreciate.

Here Are a Few Titles:

Evolution of Furnaces, Detrick Arch and Wall Construction, The New Detred Refractory Tile, Detegral Insulated Wall, Thinsulite Walls, The Streamlined Construction, Boiler Walls, Casing Applied with a Trowel, Oil Still Furnaces, For Every Type of Steel Furnace, Detrick Refractory Hanger Construction, Air-Cooled Walls, Insulated Walls, Designing a Heat-Tight Wall, Detrick High-Temperature Insulation.

For those who have a problem in heat enclosure now . . . for those who contemplate such construction in the future, a copy of this new Detrick catalog is ready. Your copy will be sent on request, without obligation.

M. H. DETRICK COMPANY
140 South Dearborn Street • CHICAGO

DETRICK FURNACE ENCLOSURES

Case #537 - Finding a Better Way to Encase a Steam Generator

When Bigelow-Liptak engineering principles and ingenuity were applied to the problem of enclosing a central station unit, a better and more economical encasement resulted.

HOW TO ENCASE a high head steam generator with an enclosure that would satisfactorily and economically back up closely spaced water wall tubes in the furnace was just one of the factors to be considered by one of the nation's largest public utility plants. The tubes and the encasement had to be independent and free to move under varying conditions of operation and to permit removal of the tubes at any time. Low radiation losses would have to be maintained in the furnace.

A steel casing would be used around the boiler to a height of only twelve feet to protect the insulation against mechanical damage. The encasement above would have to be made effective and present a workmanlike appearance without a steel casing.

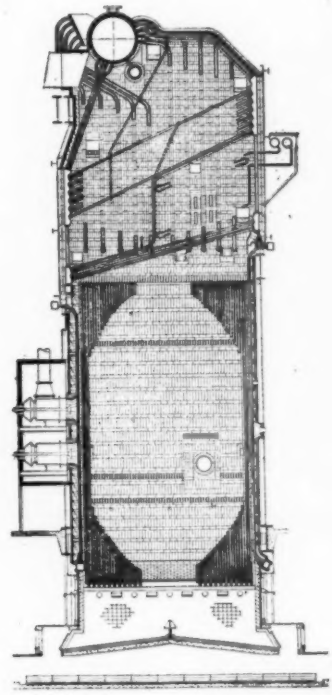
The steam generator above the furnace area would also have to be enclosed without a steel casing, assure low conduction and radiation losses, and provide complete insurance against air infiltration. Convection areas of boilers of this type carry high draft differentials and are consequently vulnerable to air infiltration, lowering overall efficiencies because: (1) the weights of the products of combustion are increased by the added air, (2) the boiler exit gas temperatures are increased. As a result, the sensible heat content leaving the boiler is increased. Finally, costs had to be a factor, as operating savings would have to justify the capital investment.

The Solution

A complete analysis of this boiler encasement problem was made by Bigelow-Liptak engineers. A study was made of furnace temperatures; burners; draft and firing conditions; tube, drum and header arrangements, supports and movements; penetration of water wall circulators, superheater headers, soot blowers; and finally, designed performance was evaluated against costs.

From this multitude of data, a preliminary design was worked up. Bigelow-Liptak engineers visited the boiler manufacturer and made necessary alterations at the factory. Time was saved. Customer was relieved of worry of "tying together" various trades.

Other Bigelow-Liptak engineers proceeded with general assembly drawings and layouts for tile and castings. A thoroughly satisfactory and economical encasement was developed and another problem was solved by Bigelow-Liptak engineering principles and skill.



For the burner wall of this central station unit, the B-L 9-Inch Heavy-Duty Double Wall was selected while the 3-Inch Budget Wall was selected for all tube areas. All walls were backed up with high quality block insulation with finish coats of insulating cement applied on expanded metal reinforcing. Entire insulation was designed in accordance with B-L standard practice of sealed insulation wherein the wall supporting castings never penetrate the insulation between columns, insuring lowest conduction and radiation losses. This provided a clean, smooth, uninterrupted encasement which will retain its air-tight integrity during its entire life because the encasement is tied-in intimately with the supporting steel structure.

Engineering Information
No Obligation

Our engineering staff will be glad to send you interesting catalogs or tell you how you could secure increased service and economy by the use of Bigelow-Liptak Unit-Suspended walls and arches in your plant. Write today.

Bigelow-Liptak Can Help You

if you have an enclosure problem

The list of Bigelow-Liptak installations reads like a who's who in American Industry. In this long list are included every type and size of enclosure in which thermo-dynamics, ceramics, and mechanics of materials are factors.

The solution of these many problems by the application of Bigelow-Liptak engineering principles and skill serves to illustrate the extra value you may gain by discussing your problems with Bigelow-Liptak.

Unit-Suspended Walls + Arches

The Key to Operating Economy

BIGELOW-LIPTAK CORPORATION
DIVISION A. P. GREEN FIRE BRICK CO.
330 Curtis Building
DETROIT

BIGELOW LIPTAK *Corporation*

Wartime Tempo for Peacetime Production

WARTIME tempo for peacetime production is the keynote to planning a postwar program to "win the peace". We must keep up the pace. Employment levels must be maintained. Absorbing your share of the available man power when the war is *ended*, is a definite patriotic obligation, as well as an economic safeguard.

New standards of quality in workmanship and materials are being evolved . . . new methods of manufacture . . . new records in production speed. Conversion of present equipment will be inadequate to meet the demand for goods and materials. Obsolescence of much present equipment is inevitable. New, modern, more economical equipment will be the final answer . . . all of which means keener, tougher competition.

The demand will be there. Will you be prepared to meet it with "enough and on time"?

Let us do our bit toward this end by helping you plan your future piping requirements. Pittsburgh Piping and Equipment Company's products and services include: COMPLETE PIPING SYSTEMS for Central Station, Chemical and Process Plants, Industrial Piping, designed, fabricated and installed; CREASED BENDS, SUPERFLEXIBLE CORRUGATED TANGENTS; WELDED TUBING and FABRICATED STAINLESS PIPING; STAINLESS WELDING FITTINGS, TANKS and VESSELS.

Pittsburgh Piping and Equipment Company's forty years of successful experience in research, engineering and development in the fabrication of *single units* or *complete piping systems* qualifies us to make recommendations concerning any changes you may contemplate. Any immediate replacements, improvements, or additions to present equipment should be planned with an eye to future specifications.

Start your postwar program today. Let our engineers help you plan improvements, additions, or complete new plants. Contact our nearest representative or write us direct. There is no obligation.

INVEST TODAY IN BONDS FOR VICTORY

Pittsburgh Piping AND EQUIPMENT COMPANY
10 FORTY-THIRD ST., PITTSBURGH, PA.

Woolworth Building, New York · · Occidental Building, Indianapolis · · Peoples Gas Building, Chicago · · Book Tower, Detroit
Public Square Building, Cleveland · · 10 High Street, Boston · · 525 Market Street, San Francisco

*NEUTRALIZATION

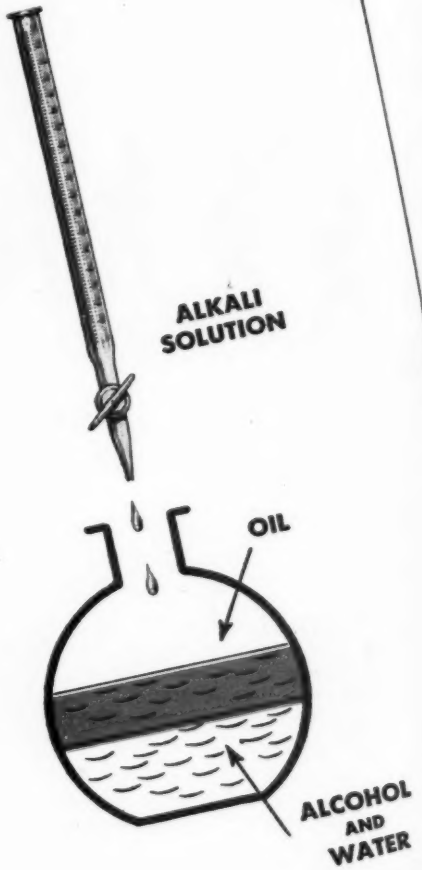
DEFINITION: The neutralization number is the weight in milligrams of the amount of potassium hydroxide (KOH) required to neutralize the acid constituents in one gram of oil.

NEUTRALIZATION TEST: Following a carefully prescribed procedure, a definite quantity of oil together with a mixture consisting of equal parts distilled water and alcohol are agitated thoroughly and heated to boiling. A phenolphthalein indicator is added and a solution of aqueous potassium hydroxide of definite strength is poured into the mixture in small increments and shaken vigorously each time. The first appearance of a sharp pink color throughout the alcohol water layer indicates the point of complete neutralization.

The number of milligrams of potassium hydroxide per gram of oil required to achieve this result is called the Neutralization Number.

SIGNIFICANCE: Corrosive mineral acids are sometimes used during the refining process of certain crudes. As a precaution against their presence in harmful proportions, it is customary to specify a maximum Neutralization Number of 0.10 for clear colored, straight mineral lubricating oils.

The Neutralization Number has no such significance in connection with unfiltered cylinder oils and black oils. These may contain larger amounts of harmless organic acids originating in the crude petroleum. High Neutralization Numbers do not imply corrosive acidity with compounded oils; i.e. mixtures of mineral oils and fatty oils. The latter oils are often inherently high in organic acidity.



INDUSTRIAL TYCOL OILS-GREASES

OIL IS AMMUNITION
USE IT WISELY!

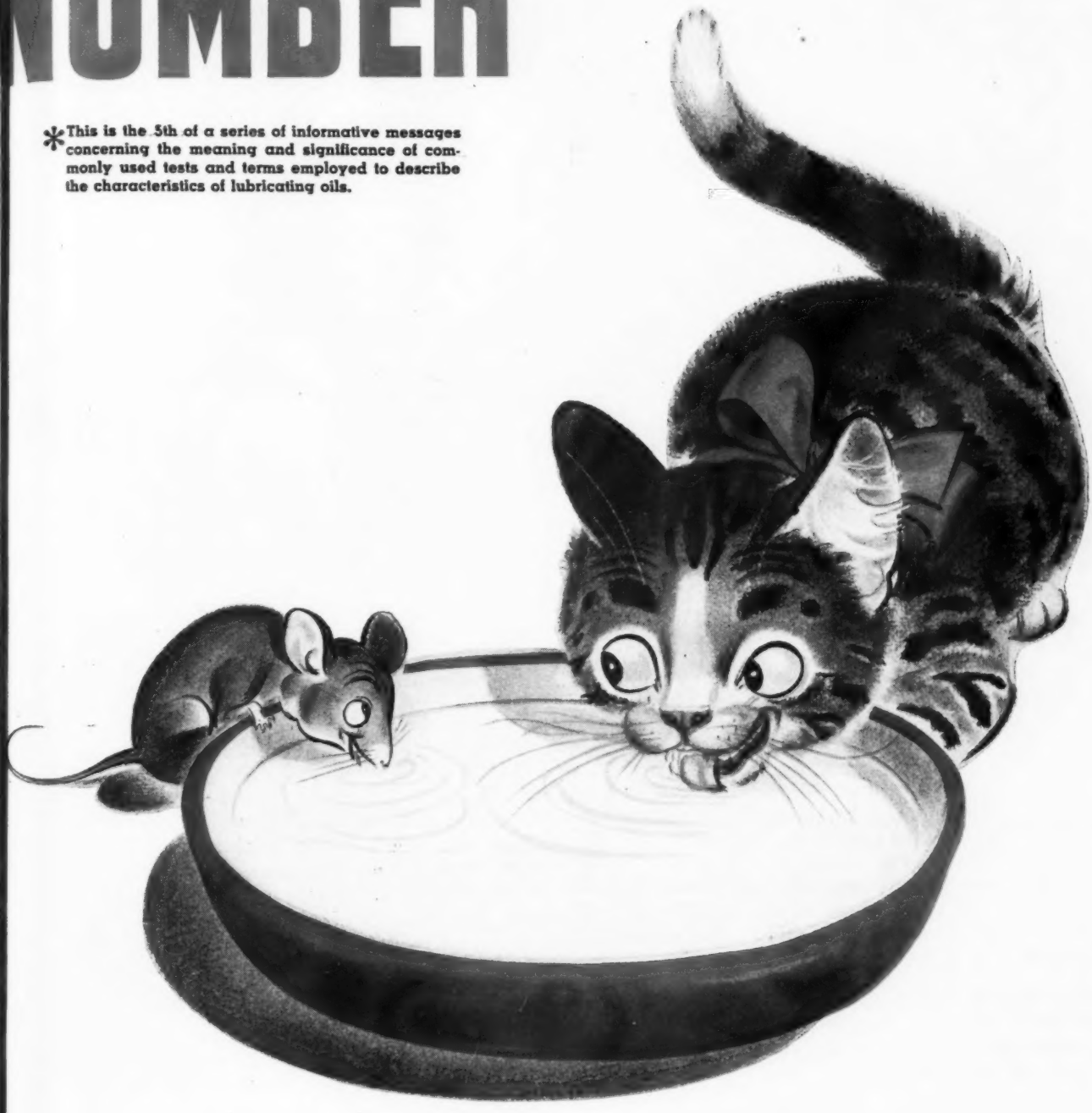
DRUMS! DRUMS! DRUMS!
War needs make it extremely important that all empty drums be returned immediately.

SCIENTIFICALLY ENGINEERED FOR EVERY INDUSTRIAL USE

TYCOL

NUMBER

*This is the 5th of a series of informative messages concerning the meaning and significance of commonly used tests and terms employed to describe the characteristics of lubricating oils.



Tycol lubricants are manufactured in a comprehensive line so as to meet every specific operating requirement. Whether straight mineral or compounded, they are produced under rigid control to assure freedom from all harmful acidity.

Tide Water Engineers will recommend the Tycol lubricant best suited to your particular requirements.

TIDE WATER ASSOCIATED OIL COMPANY

Eastern Division: 17 Battery Place, New York 4, N. Y. • *Principal Branch Offices:* Boston, Philadelphia, Pittsburgh, Charlotte, N. C.

MAKERS OF THE FAMOUS VEEDOL MOTOR OIL

INDUSTRIAL LUBRICANTS

THE STRAW THAT BREAKS THE CAMEL'S BACK..... MAY WIN THIS WAR

PROVERBIALLY, just one straw too many breaks a camel's back.

In our present struggle to crush the Axis, it may be just one shell too many, a few too many planes . . . a few too many bombs on Berlin and Tokio . . . that will crack the backbone of Axis resistance.

And it may be some production man, some engineer, some plant executive . . . it may be you . . . that will speed the production of the "straw" . . . the shell, plane, bomb or tank that will win this war.

We Would Like To Help You

Your nearby Morse representative and Morse factory engineers will be glad to consult with you, to furnish advice, backed by years of familiarity with power transmission problems, *right now*—if you are engaged in vital war work, and have *any kind* of a power transmission problem.

We will be glad to show you how, by modernizing your present machines, or the machines you build, with Morse Chain Drives, you can accelerate production by eliminating frequent breakdowns . . . make production more uniform by transmitting a constant and more uniform power flow . . . and eliminate power losses due to drive slippage. Morse Chain Drives, replacing old-fashioned, slipping drives, have upped production as much as 25% for manufacturers.

Morse would like to work with you, to have a hand, perhaps, in speeding the production of the "straw too many" that will break Axis resistance.

Morse, with more than forty years' experience in the manufacture of power transmission equipment, makes:—silent chains, roller chains, sprockets, Morflex Couplings, radial couplings, silent chain couplings, free wheeling clutches, Pullmore multiple disc clutches, silent automotive timing chains, marine reduction gears and special drives engineered to the job. Morse equipment is used in tanks, planes, ships and guns . . . and in the manufacture of a great many ordnance items. Inquiries are invited.

SILENT CHAINS ROLLER CHAINS FLEXIBLE COUPLINGS CLUTCHES

MORSE *positive* DRIVES

MORSE CHAIN COMPANY ITHACA, N. Y. DETROIT, MICH. DIVISION BORG-WARNER CORP.

WING pioneered the Axial Flow Blower for use in industrial plants over six years ago.

Type EMD (single stage)

(Below) Phantom view of TYPE COM (two-stage)

Firing aisle in chain-grate equipped boiler plant of well-known engineering college, showing at left two vertical WING Type COM Axial Flow Blowers.

FORCED DRAFT FOR ALL-OUT WAR PRODUCTION

WING Axial Flow BLOWERS are operating on both the industrial front and the actual battle-front in supplying forced draft for the boiler plants of our great war plants and in the Navy and Maritime Shipping both for forced draft and for ventilation. These blowers are characterized by:

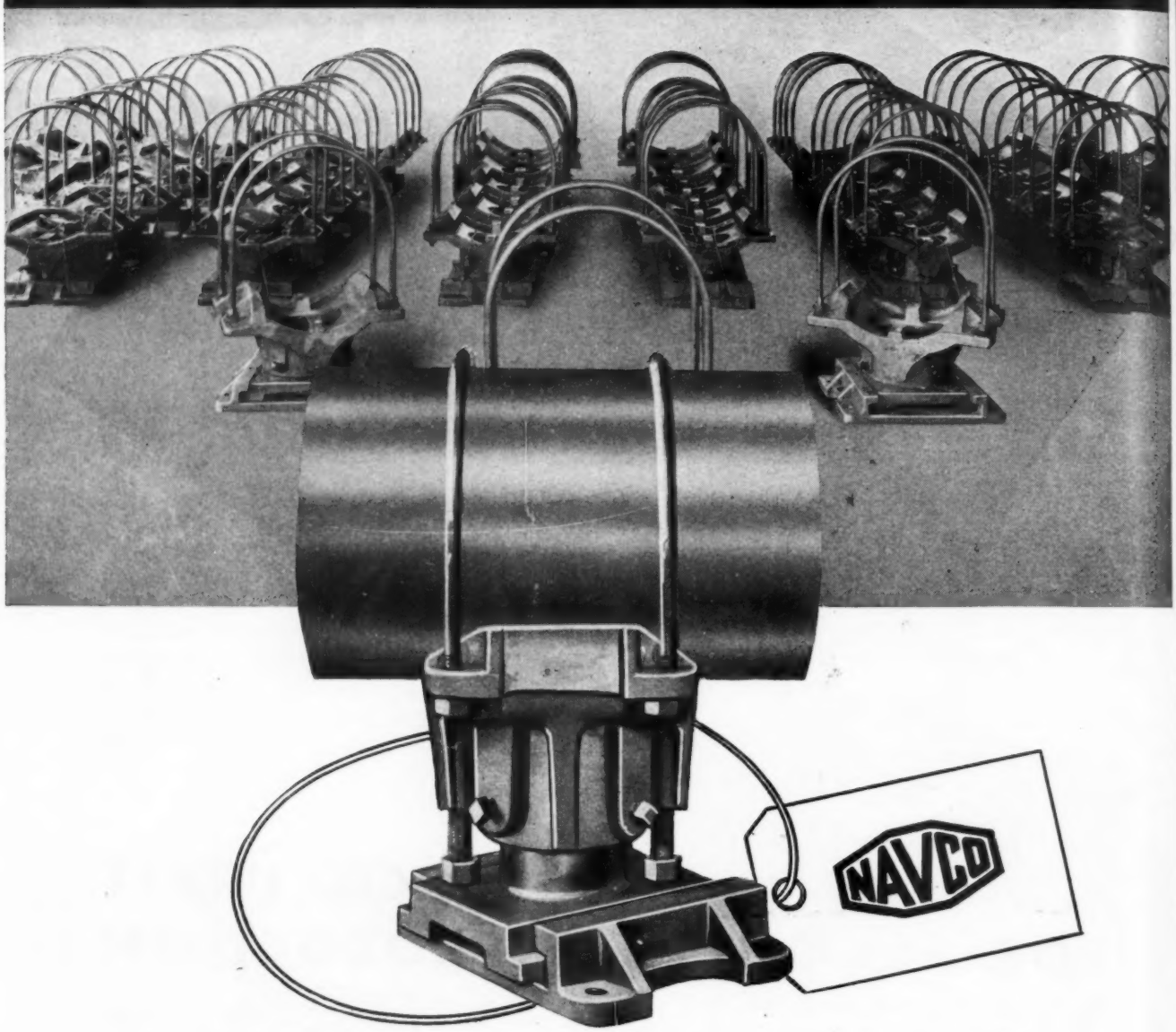
1. HIGH EFFICIENCY
   Total Head Efficiencies run 90% and higher
2. NON-OVERLOADING HP CHARACTERISTICS
3. GREAT COMPACTNESS
   Economy of Space and Weight
4. EASE OF CONTROL
5. QUIET OPERATION

Write for a copy of new Bulletin CO-5

L. J. WING MFG. CO. • 7th Ave. & 14th St. • NEW YORK CITY

WING AXIAL FLOW BLOWERS

NAVCO "UNIVERSAL" PIPE SUPPORTS



Navco Universal Support will take care of eight inches of expansion and can be made special to accommodate any amount of travel.

Vertical adjustment up to 2½ inches can be made.

Support may be turned to any angle of 360°.

Holds pipe down as well as up. Prevents pipe from getting out of alignment, which is usual in the Roller Type of support.

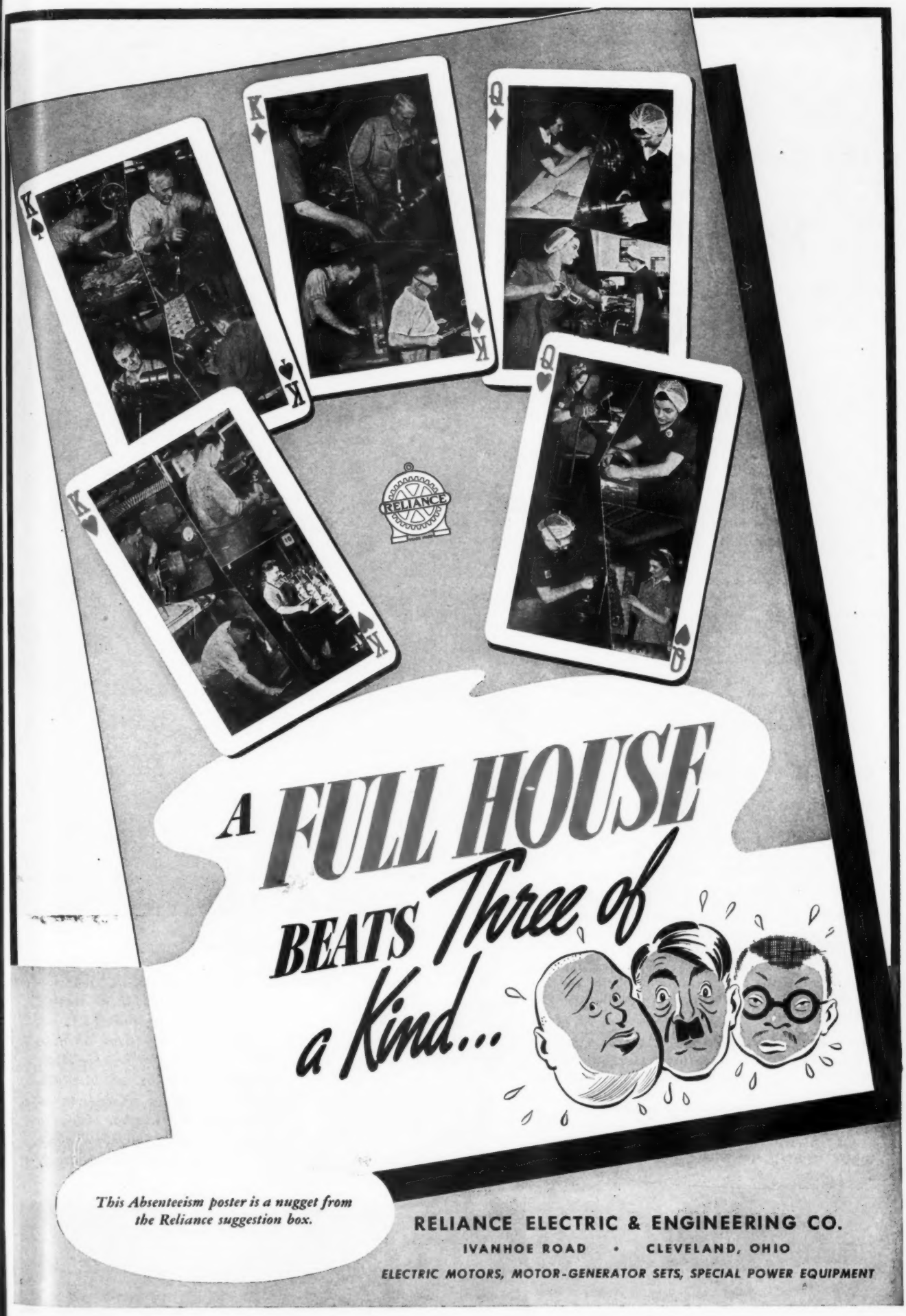
It permits control of expansion movement of pipe and insures the desired free action of Slip Expansion Joints so essential in tunnel and duct work.

Carrier is fixed to a predetermined point on the pipe, thereby eliminating possibility of destroying insulation. There is a recess in the saddle for insulation and the entire support can be insulated on the outside.

Navco Universal Pipe Supports are made of cast iron but can also be furnished in steel at increased prices. For installations exposed to the weather, bases can be furnished with brass liners or provided with forced lubrication.

NATIONAL VALVE MANUFACTURING COMPANY • PITTSBURGH, PA.

ATLANTA BUFFALO CLEVELAND CHICAGO NEW YORK PHILADELPHIA



This Absenteeism poster is a nugget from the Reliance suggestion box.

RELIANCE ELECTRIC & ENGINEERING CO.

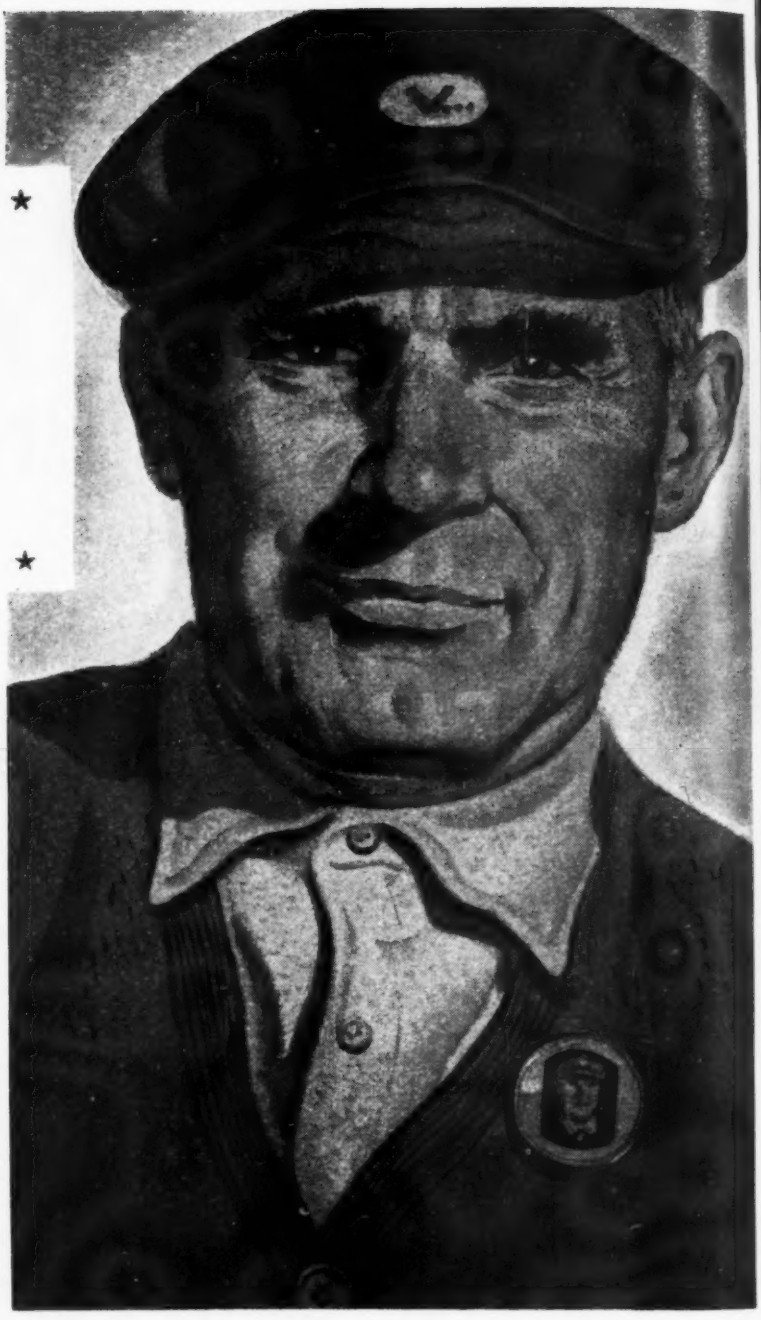
IVANHOE ROAD • CLEVELAND, OHIO

ELECTRIC MOTORS, MOTOR-GENERATOR SETS, SPECIAL POWER EQUIPMENT

★ ★ ★ ★ ★ ★ ★ ★ ★ ★

Manpower Is Critical

★ ★ ★ ★ ★ ★ ★ ★ ★ ★



Our dwindling supply of manpower is rapidly becoming the most critical shortage of our immense wartime program. This acute condition imposes a great hardship on our war industries producing fantastic quantities of planes, ships, tanks and numerous other weapons of war.

Deltabeston Asbestos-insulated Wires and Cables are helping power superintendents save many precious working hours by reducing maintenance time to a minimum. Deltabeston is performing with the utmost dependability on essential war jobs all over the land. It lasts and does the job well . . . where excessive heat causes constant maintenance and frequent replacements of other cables.

General Electric manufactures:

DELTABESTON POWER CABLES TYPES AVA or AVL for wiring in power plants, steel mills and in other torrid zones where constant high temperatures prevail. Insulated with felted asbestos, varnished cambric insert and asbestos braid or lead sheath.

DELTABESTON SWITCHBOARD AND HINGE CABLE TYPES AVB or SNA for wiring swinging panel connections, general switchboards and all other types of control apparatus. Insulated with varnished cambric or extruded synthetic, felted asbestos, flameproof braid finish.

DELTABESTON BOILER ROOM WIRE TYPE AVA for wiring in central stations, steel mills, boiler rooms and other installations where resistance to high ambient temperatures is required. Insulated with felted asbestos, varnished cambric insert and asbestos braid. And numerous other wires and cables to help speed the day of Victory!

Here's the answer to your wiring problems where heat endangers. It's yours for the asking. Just write to Section Y732-52, Appliance and Merchandise Dept., General Electric Co., Bridgeport, Conn. Deltabeston Wires and Cables are distributed nationally by Graybar Electric Co., G-E Supply Corp. and other G-E Merchandise Distributors.

WHERE HEAT ENDANGERS USE DELTABESTON

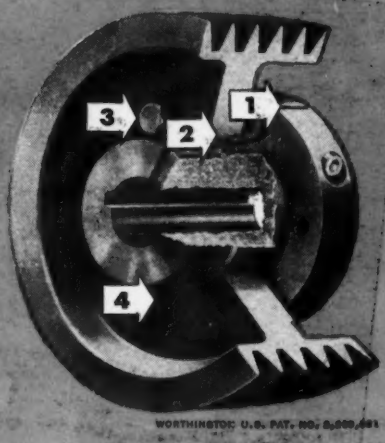
GENERAL ELECTRIC

WORTHINGTON

QD QUICK DETACHABLE SHEAVES

Installing a 48" PD "C" section 8 groove QD Sheave on a 7" stroke horizontal air compressor. The QD Sheave weighs 440 pounds, four times the girl's weight.

Superior Advantages of the QD Sheave Design Cost No More



WORTHINGTON U.S. PAT. NO. 2,009,481

1. **Split Hub** for easy mounting or removal from the shaft.
2. **Tapered Fit** between split hub and rim for easy mounting or removal of rim from hub.
3. **Pull-up Bolts** which hold the rim onto tapered split hub for tapered friction drive assembly and positive press fit on the shaft.
4. **Tapped holes** in rim for using pull-up bolts as jack screws to free the tapered friction fit when detaching the rim.

NOW AVAILABLE for DriveN as well as DriveR applications

Women assembling GIANT DRIVEN SHEAVES, no longer are an oddity to be headlined in Ripley's "Believe It Or Not." INEXPERIENCED "GREEN" HELP in assembly plants find these sheaves simple to mount.

The problems of assembling and maintaining Vital DriveN and DriveR machinery have been greatly simplified with the introduction of the Worthington patented QD Sheave with its "Easy To Get On—Easy To Get Off, YET ALWAYS TIGHT ON THE SHAFT" features.

The QD Sheave design has now been incorporated into a complete range of DriveN and DriveR sizes that will accommodate 10,000 drive combinations up to 150 horsepower from stock.

One demonstration will convince you that a wrench and inexperienced hands are all that are needed to install or remove a QD Sheave, regardless of size. Arrange for your demonstration today—write or call the Worthington Multi-V-Drive dealer or the Worthington District Office in your territory.

Mail the Coupon NOW for this New Bulletin

I would like more information about the Time, Labor, and Material Saving Advantages of the Worthington QD Sheave.

Name _____ Title _____

Company _____

Address _____

City _____ State _____ County _____

Product Manufactured _____

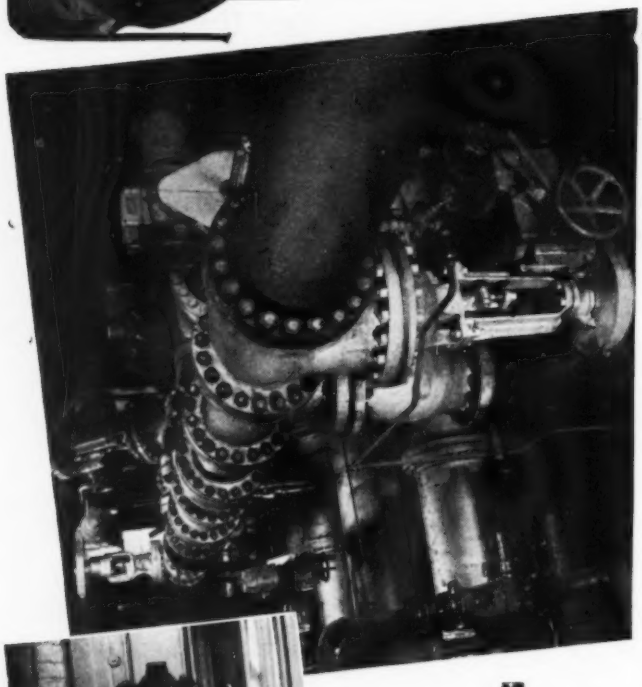
MV3-10

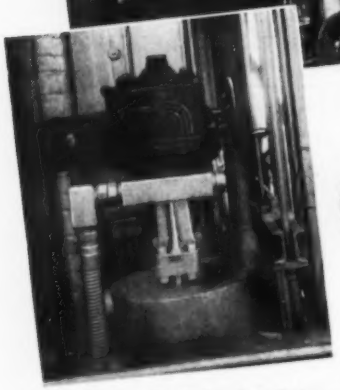
WORTHINGTON

COMPLETE DRIVES **MULTI-V-DRIVES** SHEAVES OR BELTS ONLY

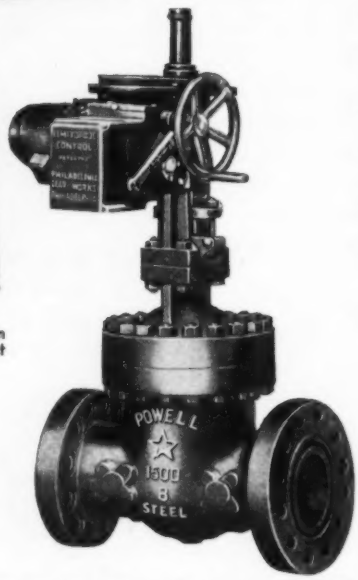
WORTHINGTON PUMP & MACHINERY CORPORATION • GENERAL OFFICES: HARRISON, N. J.

Extra Hands FOR YOUR KEY WORKMEN





Limitorque Controls installed in Central Stations on East and West Coasts.



Philadelphia LIMITORQUE CONTROLS operate Valves in all parts of the plant from one central control panel

The automatic opening and closing of valves from a centrally located master control panel not only permits this function to be handled by men of greater responsibility but makes possible more complete synchronization of entire plant operations. The proved dependability of Limitorque Controls makes certain that the valves will operate without fail by the simple push of a button.

All types of valves, from 3" to 96" diameter can be fitted with Limitorque. Also these controls are adaptable to existing equipment.

For more details, get our Limitorque Catalog.

PHILADELPHIA GEAR WORKS, INC.

Industrial Gears and Speed Reducers ***Limitorque Valve Controls***

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.

PRE-FABRICATED PIPING IS BETTER PIPING

P.F.I.
THE PIPE FABRICATION INSTITUTE

THE PIPE FABRICATION INSTITUTE

Devoted to the Technical and Economic Problems in Piping

1108 CLARK BLDG. • PITTSBURGH, PA.

Production of pre-fabricated piping is planned by men of long experience in the practical possibilities and limitations of piping . . . it is prepared in plants equipped with modern machinery and staffed by highly skilled organizations including pressure welders whose work can be insured.

Pre-fabricated piping is delivered to the job in a series of subassemblies with all difficult operations performed. These subassemblies are commercially practical, heat treated and stress relieved where necessary, correctly aligned, thoroughly cleaned, shop tested, and inspected.

Pre-fabricated piping by a qualified fabricator is better piping. It saves money—and what is even more important—it saves time and trouble.

F-2

What will follow Victory? Don't wait to find out; anticipate it by redesigning your machines now and using more Timken Bearings.
CLEVELAND

POWER *reaches its objective without loss on Timken Bearings*

Timken Tapered Roller Bearings are valuable factors in keeping power on the move from source to point of application.

Installed in line shaft hangers, pillow blocks, gear drives or any kind of transmission equipment, they greatly reduce involuntary power interruptions; prevent power loss; protect equipment against wear, radial, thrust and combined loads and misalignment of moving parts; simplify lubrication; and decrease maintenance requirements.

The Cleveland Type 300 AT Worm Gear Speed Reducer shown in the photograph is one of a number of these units that have been driving lines of tumbling barrels in a large malleable plant for years. They are equipped with Timken Bearings on high and low speed shafts, as are other types of Cleveland speed reducers.

The more Timken Bearings that go into action in production equipment of all kinds, the closer Victory becomes. Are you using as many as possible in your equipment? The Timken Roller Bearing Company, Canton, Ohio.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

IN DESUPERHEATING SERVICE . . .

"THIS PUMP HOLDS TEMPERATURES WITHIN ±1° F."

UNDER FULLY AUTOMATIC CONTROL

In an eastern public utility station, an Aldrich-Groff controllable capacity "Powr-Savr" Pump has been in almost continuous operation for nearly three years, supplying water for desuperheating steam. Arranged for automatic temperature control, its response is such that "the indicating and recording instruments show a total variation of only 1° F. from the desired temperature". This pump has a variable capacity from 0 to 65 GPM at a constant pump speed of 190 RPM against 350 lbs. pressure and is driven by a 20 HP 1750 RPM constant speed A.C. motor.

Aldrich-Groff Pumps provide for automatic or remote manual control of delivery from zero to full rated capacity at constant pump speed. Rate of delivery is controlled by variation of the length of plunger stroke and power consumption is almost directly proportional to pump delivery. They offer the advantages of feed system simplicity, efficiency and mechanical reliability of the small and medium boiler plant using medium or high steam pressures, and for desuperheater feed service in even the largest power stations.

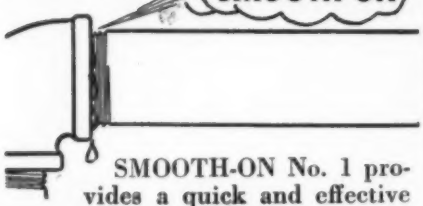
Write for bulletins and material giving full details, sizes and ratings of Aldrich-Groff Pumps.

THE ALDRICH PUMP COMPANY
ALLENTOWN · PENNA.

THE ALDRICH-GROFF CONTROLLABLE CAPACITY "POWR-SAVR" PUMP
TRADE MARK

STEAM LEAKS

Sealed with SMOOTH-ON



SMOOTH-ON No. 1 provides a quick and effective way to seal a leaking screwed pipe connection . . . without dismantling or the use of heat. Leaks at flanged joints, either at the pipe threads, bolt holes, or around the circumference, can also be sealed with SMOOTH-ON.

Many other SMOOTH-ON repairs.

SMOOTH-ON also seals cracks in casings of pumps, heaters,, engines, condensers and other cast shells, stops leaks at seams and rivets, and tightens loose fixtures and parts of apparatus and structures.

SMOOTH-ON is a real necessity because of the difficulty of obtaining new equipment and parts. Be sure to have a can handy to repair what you can't replace.

Buy SMOOTH-ON in 7-oz., 1-lb., or larger containers from your supply house, or if necessary from us. For your protection, insist on SMOOTH-ON, used by engineers and repair men for over 45 years.

FREE

REPAIR HANDBOOK SHOWS HOW

40 Pages, 170 diagrams, and simple concise instructions for practical repairs to plant equipment, pipe lines and structures. A necessity in every plant. Your copy sent FREE if you fill in and return the coupon.

SMOOTH-ON MFG. CO., Dept. 30
570 Communipaw Ave., Jersey City 4, N. J.
Please send SMOOTH-ON HANDBOOK.

Name .....

Address .....

7-43

Do it with
SMOOTH-ON

HOW BIG

can an Air Express shipment be?

AS TO WEIGHT, your shipment may be a pound or a ton and up, so long as it fits in a plane. **AS TO SIZE,** you will be safe in following dimensions shown underneath the illustration.

However, large shipments can often be broken into a number of smaller units. When this is impossible, consult your local Railway Express Agency, who can often make special arrangements for handling larger shipments.

FOR FASTEST DELIVERY, ship early, as soon as package is ready. PACK COMPACTLY but securely, to cut AIR EXPRESS costs.

Maximum dimensions for AIR EXPRESS *packages: Length, 35 to 49½ inches; width, 44 inches; depth, 18½ inches. Break larger shipments into smaller units whenever possible.*

Air Express Speeds War Program

TODAY, AIR EXPRESS not only serves the home front but is also working hand in hand with the Army and Navy to supply our fighting fronts throughout the world.

TOMORROW, AIR EXPRESS will girdle the globe in international peacetime commerce . . . to bring *all* foreign markets to the doorstep of American business.

Phone RAILWAY EXPRESS AGENCY, AIR EXPRESS DIVISION
Representing the AIRLINES of the United States

WRITE for our quick-reference handbook on "How to Ship by AIR EXPRESS During Wartime." Dept. PR-2, Railway Express Agency, 230 Park Avenue, N.Y.C.

AS RECENTLY ANNOUNCED, *we are now building "Megger" instruments in this country, and are in production on the popular "Meg" and "Super-Meg" types. The acceptance accorded these new all-U. S.-made instruments has added to our already large backlog of orders, which we are now filling as rapidly as possible. Your orders for "Megger" instruments will be accepted according to priority ratings and with our assurance that delivery will follow as quickly as our further-expanding facilities will permit.*

FORESTALL electrical breakdowns... WITH THE "MEGGER" TESTER!

Now, more than ever, it is vital to hold electrical failures to a minimum. Periodic testing of the insulation of motors, generators, cables, signal-control and other electrical apparatus can save priceless time and protect irreplaceable equipment. Testing with a "Megger" instrument is only a matter of minutes, but it can reveal potential damage and save days of costly delay.

"Megger" insulation testers are completely self-contained—wholly independent of batteries. Simply connect to the equipment under test, turn the hand cranked generator and read insulation resistance directly by the pointer over the scale. Over 40 years of service in industry has proved the value of "Megger" Practice.

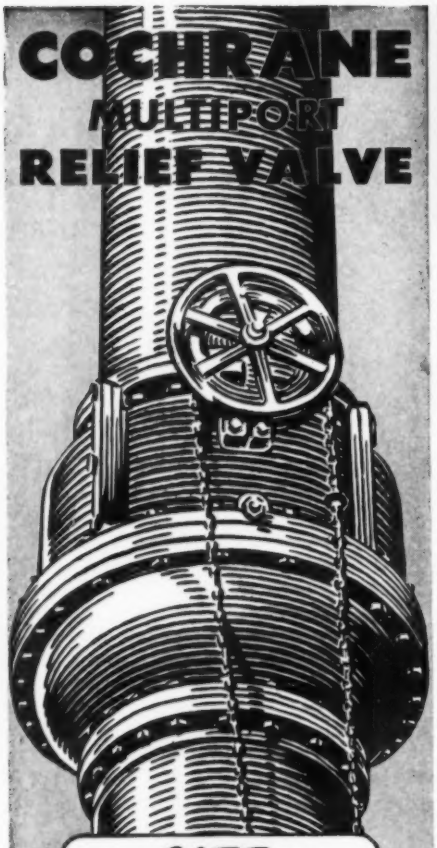
Write for any or all of the bulletins listed and a free copy of the Pocket Manual of "Megger" Practice, No. 1420-P.

BIDDLE BULLETINS

- Use of Hand-driven "Megger" Testers, Bulletin 1655-P.
- How to Test Insulation and Avoid Trouble in Electrical Equipment, Bulletin 1640-P.
- Various types of "Megger" Insulation Testers, Catalog 1685-P.
- Bulletin 1735-P on the New U. S.-made "Megger" Insulation Tester in plastic molded case.

JAMES G. BIDDLE CO. • 1211-13 ARCH STREET • PHILADELPHIA 7, PENNA.

COCHRANE MULTIPORT RELIEF VALVE



The **SAFE** Valve

For BACK PRESSURE ATMOSPHERIC RELIEF AND FLOW OR CHECK VALVE SERVICE

Danger from sticking, jamming or freezing is eliminated by the multiplicity of valve disks instead of one large disk.

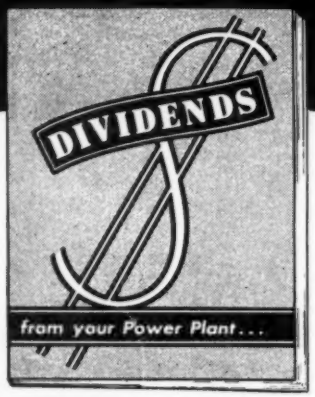
Chattering and pounding are also absent because the valve disks are light in weight with short travel and are further steadied by individual cushion chambers. Pressure is easily adjusted by varying the compression of the valve springs, which is done by shifting the pressure plate by means of a hand wheel, chain or motor.

Write for a copy of Publication 2870

COCHRANE CORP.

3106 N. 17th St., Philadelphia, Pa.

NEW BOOKLET FREE



to these men

1 The engineer who is interested in operating his plant economically as well as dependably.

2 The engineer who knows a plant manager who should know more about power plants.

3 The engineer who wants to enlist the full cooperation of his company executives in the operation and improvement of his power plant.

4 The engineer who is planning for the future—when war restrictions no longer prohibit needed changes.

IF YOU *qualify on any one or more of the foregoing counts—you should get a copy of "Dividends From Your Power Plant." This booklet has page after page of information and ideas that are ready to be put to use—for you.*

It is not a sales bulletin. It is being distributed as a service to those with whom we hope to do business when priorities no longer govern the placing of business. For details, simply fill in the coupon below and mail to—

Preferred Utilities Company, Inc.
33 West 60th St., New York 23, N. Y.

PREFERRED UTILITIES — Rigged for Results — ENGINEERS

PREFERRED UTILITIES

MANUFACTURERS OF UNIT STEAM GENERATORS

COUPON FOR YOUR CONVENIENCE

PREFERRED UTILITIES CO., 33 WEST 60th ST., NEW YORK CITY

Name _____

Company Name _____

Address _____

P-743

WAR CONDITIONS

DEMAND PACKINGS BE CONSERVED!

In the 50 years existence of this Company, never have Belmont Packings been in greater demand, more urgently needed.

Packings are important! They are essential not only in the production, but in the operation of guns and mobile equipment—tanks, planes, ships.

Materials used in the complete line of Belmont Packings come from far-off places—asbestos, flax, jute, rubber, lubricants. Supplies of these critical raw products have been restricted, by regulation, to war uses. In substance, demands and problems are great, the like of which the world has never seen before!

How can Belmont meet the situation? It must continue to work to capacity with tools available.

How can the user meet the situation? He can conserve the use of packings along the lines of the four suggestions below.

THE BELMONT PACKING & RUBBER CO. — BELMONT — PHILADELPHIA, U.S.A.

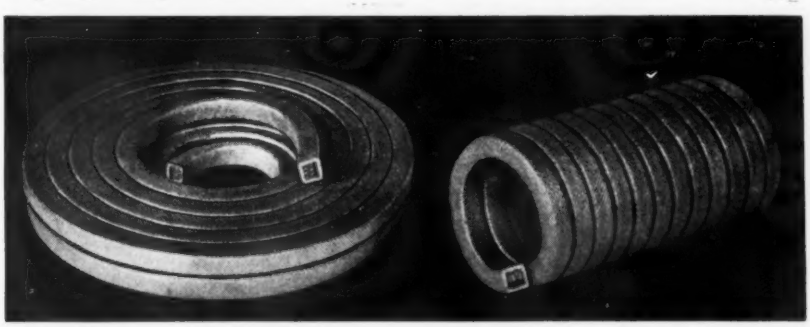
A—CONSERVE PACKINGS—When repacking, it may be found that a few rings of new packing inserted next to the gland may give added service. This will mean conservation of old packing retained in the stuffing box.

B—LUBRICATE MOVING PARTS—Keep rods, shafts and plungers thoroughly swabbed with oil or grease to alleviate frictional wear on packing. Where practicable, install oil lanterns.

C—CHOOSE SUBSTITUTE CONSTRUCTIONS—When material shortages make your desired type not instantly available, consult with your nearest Belmont distributor or with us for guidance on this question.

D—REFER TO THE BELMONT CATALOG—It's an invaluable packing guide of complete information on packings for all services . . . it contains informative charts; clearly illustrates and describes every Belmont packing; and suggests varied packing styles from which to choose a substitute packing, if necessary. Write on your Company letterhead for your copy.

There's a Belmont Packing for every service . . . Steam, Water, Oil, Gas, Air, Acid, Alkalis, and Ammonia. Forms include Rings, Coils, Spirals, Reels, Spools, Sheets, and Gaskets.



BELMONT PACKINGS

The Belmont Packing & Rubber Company

Butler and Sepviva Streets **Philadelphia, Penna.**

MAKE
MANHOURS
COUNT FOR MORE

Now, when manpower is a big problem, make this important time saving. Use Adamant Cement to lay up furnace linings and get longer service life before relining is needed. It can be done . . . because

★ **ADAMANT** ★
FIRE BRICK CEMENT

makes the joints as strong as the brick they bond. For proof read this . . . Impartial laboratory tests by one of America's leading technical institutes showed Adamant has a bonding strength of 800 lbs. per sq. in. at room temperature, 1270 lbs. per sq. in. at 2600° F. Adamant has a P.C.E. of over 3000° F. *"Its strength increases as the temperature rises."*

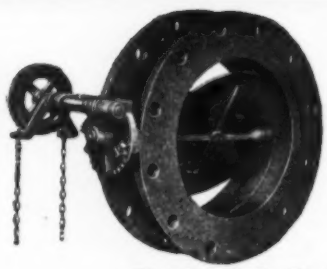
ADAMANT has a P.C.E. of over 3000° F.

For more details . . write

BOTFIELD
REFRACTORIES COMPANY

784 S. Swanson St., Philadelphia (47), Pa.
In Canada, Canadian Botfield Refractories Co. Ltd. 171 Eastern Avenue, Toronto

ROCKWELL
BLAST GATES



Flanged Butterfly Type with Chain Wheel Control

Win Repeat Orders

Rockwell Blast Gates assure perfect control of low-pressure air . . . after long use as well as when new. Distributors find them profitable to sell because they require no servicing and their uniformly excellent operation wins repeat orders. Write for Bulletin 4026 describing their many advantages in detail.

W. S. ROCKWELL COMPANY
Blast Gate Division
50 CHURCH STREET NEW YORK, N. Y.

INSURE
Against Shutdowns
with
DAVIS STRAINERS

DAVIS STRAINERS contribute to uninterrupted operation of pumps, engines, turbines, valves — every device that might be damaged by pipe scale, joint compound and other foreign particles. Investment in Davis Strainers is like buying insurance on your plant.

Davis Strainers permit an unobstructed flow of steam, gas, or liquids. They can be supplied for pressures up to 1500 lbs. Self cleaning and Basket types meet most requirements. Special Davis Strainers built to meet unusual conditions.

Screens are built of heavy perforated metal, with perforated area from 2 to 5 times pipe area.

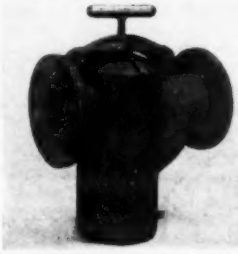
Davis No. 75, shown above. Foreign matter trapped in the cylinder may be blown off. It is seldom necessary to remove the screen from the strainer when cleaning.

Davis No. 76D, shown below. Hinged clamped cover for quick removal of basket for cleaning.

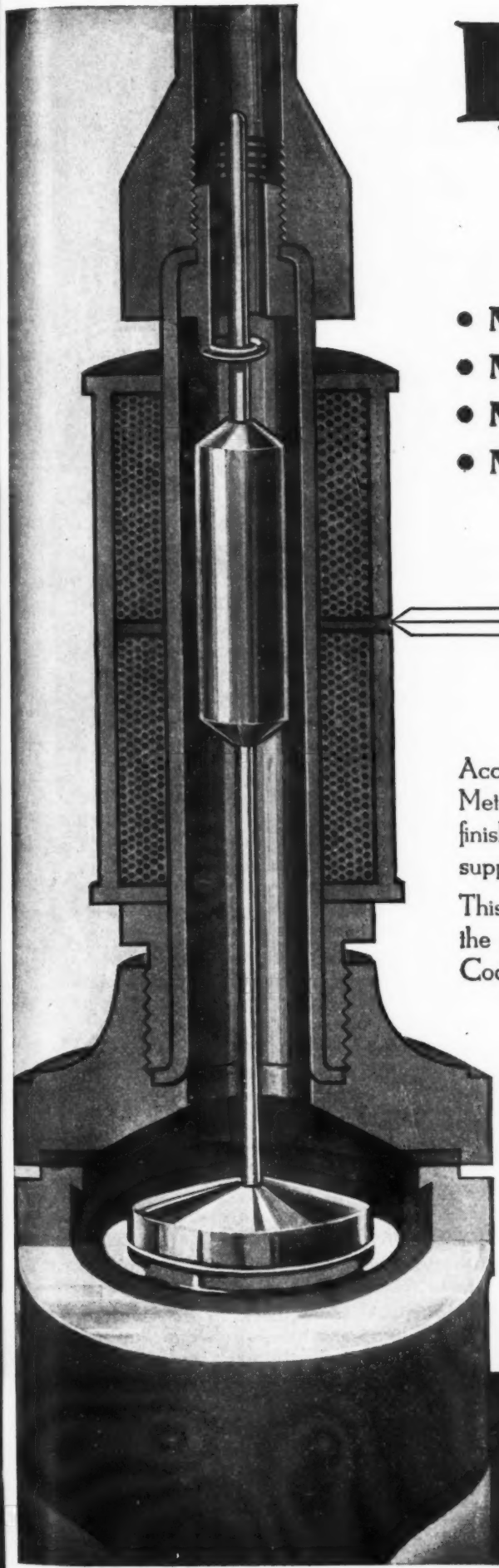
Investigate the protection offered your equipment by Davis Strainers. Write for literature.

DAVIS REGULATOR COMPANY
2540 S. Washtenaw Ave. Chicago, Illinois

Standard Sizes
3/8" to 14"
Larger Sizes Available



DAVIS REGULATOR COMPANY

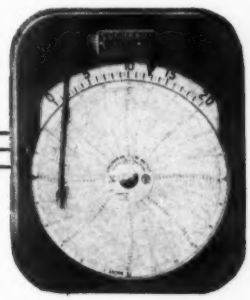


It Floats

. . . FREELY

99 44/100 % Frictionless

- **NO SOLENOID "REACTION"**
- **NO BEARINGS**
- **NO STUFFING BOX**
- **NO ELECTRIC CONTACTS**



Accuracy gets off to a good start in Cochrane Electric Flow Meters because the manometer is practically frictionless. The finish is strong, too, because at the receiver, this null system supplies high and equal power from 0 to 100% at flow.

This power comes from an auxiliary motor and not from the measuring circuit which is relieved of all work. The Cochrane Meter is a true null device.

Remember—

$$\text{Accuracy} = \frac{\text{POWER}}{\text{Friction}}$$

NOTE: A bridge circuit alone is not a null method meter. A galvanometer is required to detect unbalance and an external source of power is needed to restore balance. These are found only in the Cochrane Electric Flow Meter.

COCHRANE CORPORATION
3106 N. 17th St., Philadelphia, Pa.

COCHRANE
FLOW METERS

LOYAL AMERICANS ON STRIKE!
This NEWSPAPER advertisement was published in Washington, New York and Chicago by McGraw-Hill, to make friends for business.
GATE 3

How can we end strikes?

Management ~~vs~~ plus Labor

Wartime strikes are different from strikes in times of peace.

While most workers probably feel a sense of shame in participating in them, the fact remains that strikes are taking place.

Viewed in the abstract wartime strikes are symptoms of a basic misunderstanding of industry on the part of government.

McGraw-Hill, through newspaper advertisements, is trying to create an understanding of the changes that are necessary in present government policies in order to help keep industry functioning continuously and smoothly. The advertisement reprinted here is the latest of a series which appears every two weeks.

More and more manufacturers are recognizing the need of educating the people in their own communities, as well as their own employees, on the relationship of sound industrial progress to good living. Many companies are distributing booklet reprints of these "Seed Money" messages and are quoting them reglarly in their own bulletins, house organs and newspaper advertisements.

We will gladly supply a newspaper mat of this advertisement—in full page size—to manufacturers who wish to run it, over their own signatures, in their local newspapers.

James H. McGraw, Jr.

President

McGraw-Hill Publishing Company, Inc.

IT is unnatural for people with sons and brothers at the front to strike.

It's easy to hurl dirty words at them when they do halt war work, but maybe we'll get further if we dig down below the accusations and find out what really is the matter.

Generally strikes result from mis-managed human nature. Sometimes Labor Leaders do the mis-managing, sometimes Management itself is to blame.

► But, in wartime, both Management and Labor Leaders are having the grim experience of watching Government try its hand at managing human nature . . . So far, Government isn't doing so good.

There are many causes of strikes, but we believe the way to stop strikes that are aimed at breaking through wage ceilings is to encourage every man to feel that he is "in business for himself."

The best way to make a man feel that way is to see that he gets an automatic reward for every improvement in his work.

Today, fair and workable plans for tying wages to performance instead of artificial ceilings have been developed. They are being used successfully in many industries.

Such plans should be pushed more vigorously by Government and Labor, as well as Management.

Government is having trouble with human nature on other fronts, too.

Most of this trouble traces back to the fact that Government wants more and more production on one hand, while on the other it discourages the individual enterprise that creates production.

Much of the public resistance to sound and necessary Government acts stems from fear that regimentation and bureaucratic control of our lives is the real goal of Government.

FREE MATS: If you would like to publish this message over your own company name, or distribute it in handy booklet form, write or wire: Research Dept., McGraw-Hill Publishing Co., Inc., 330 West 42nd St., New York (18), N.Y.

How can we end strikes? (cont'd)

The real objective of Government should be to release the immense powers of *individual* effort.

After all, Government's need is simple. It wants MORE WORK DONE IN LESS TIME.

Getting more work done in less time is Industry's dish.

Doesn't it make sense, therefore, for Government to devote every effort to making it easy for Industry to do its job?

If government people want to know how industry has gotten more work done in less time, the answer is easy. Here it is:

1. Constantly improve the equipment available for workers.
2. Use the lowered costs thus produced to
   (a) lower prices to consumers.
   (b) raise wages in proportion to increased efficiency.
   (c) provide incentives for invention, investment and individual enterprise.
   (d) lay aside "Seed Money" that can be used to start over again at item 1.

Constantly Improved Equipment

► Few people ever think of "constantly improved equipment" as a helpful answer to war production, manpower shortages, raw materials shortages, food shortages and post-war jobs.

Yet constant improvement in machines and methods is our only chance for doing more work in less time.

Lower Costs Produce Lower Prices

In these days of price ceilings, we think so much of *higher* prices that we forget how easy it will be to *lower* prices when we can get better machines.

Wages in Ratio to Efficiency

With all the talk of wage freezing, we also forget that the true American system is to raise wages *without increasing prices*, through better machines and methods. Strikes for higher wages disappear when incentive wages are properly used.

Incentives for Invention, Investment and Development

► Of all the things that helped make America great, this is the one that has taken the most kicking around.

Excessive taxes on business profits, salary freezing and hundreds of other political limitations discourage the old "take a chance" spirit that built up our country.

Lower Costs Provide "Seed Money"

► Another thing you hear a lot of talk about in Washington is "Post-War Planning."

In Washington, that means public works and government spending.

In Industry, it means developing and buying new machines to produce new products to sell at lower prices to attract enough new buyers to make 20,000,000 new jobs.

The Washington plan means more taxes.

The Industrial way will pay for itself.

But Industry will need billions of dollars to convert its machines and factories back to peace work. That will cost as much as war conversion, or more.

That's why Industry needs to save its "Seed Money" now.

The only way industry can get more "Seed Money" is through a complete change of government attitudes toward industry. We hope government people will soon see that when tax laws decrease the saving of "Seed Money" (money earmarked for plowing back into a business) they strike at industry's only means of developing this country after the war.

What You Can Do About It

If you agree with this advertisement, then write to your congressman and tell him you believe in the Incentive System that has built up our country—that means Incentive for labor, as well as for invention, investment and management. Ask him to review each proposed law and regulation with this fact in mind:

"Industrial Progress is the Source of all Good Living."

THE McGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION

22 publications, which gather "war-news" from the "war-production-front" through a staff of 153 editors and 725 engineer-correspondents . . . More than 1,500,000 executives, designers, production men and distributors use the editorial and advertising pages of these magazines to exchange ideas on war-production problems.

McGRAW-HILL BOOKS

Publishers of technical, engineering and business books for colleges, schools, and for business and industrial use.

This advertisement is available in handy booklet form. (Less than 100 copies free. Larger quantities, $1.50 per 100; $10.00 per 1000.)

McGRAW-HILL

PUBLISHING COMPANY, INC. . . . BOOK COMPANY, INC.

330 WEST 42ND STREET, NEW YORK (18), N. Y.

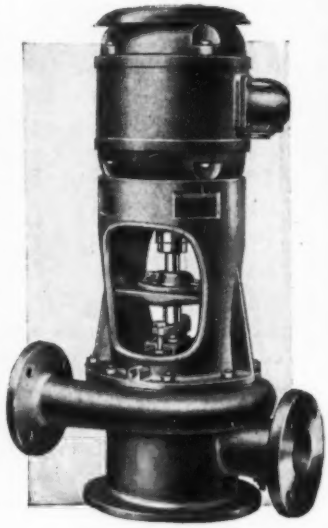
THE McGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION:

American Machinist • Aviation • Bus Transportation • Business Week • Coal Age • Chemical & Metallurgical Engineering • Construction Methods • Electrical Contracting • Electrical Merchandising • Electrical West • Electrical World • Electronics • Engineering & Mining Journal • E. & M. J. Metal and Mineral Markets Engineering News-Record • Factory Management & Maintenance • Food Industries • Mill Supplies • Power • Product Engineering • Textile World • Wholesaler's Salesman • Business Publishers International Corporation, an affiliate, publishers of Business and Technical Magazines for Latin America, and Overseas Circulation.

The ECONOMY SCV PUMP

. . . NEW . . . DURABLE . . . PRACTICAL!

- The compact, vertical design of the ECONOMY SCV Pump saves floor space . . . makes for easy and convenient mounting . . . simplifies cleaning of pump and surroundings.
- Motor is mounted high above pump mounting flange, away from dirt, spash and sweepings.
- Impeller keyed to oversize shaft rotates between inboard and outboard bearings. Insures perfect alignment — smooth, noiseless operation.
- In case of motor failure any comparable stock motor may be quickly and easily adapted.



ECONOMY Pumps are built in sizes from 1" to 3" discharges, for capacities from 10 to 500 G.P.M. . . . heads up to 225 feet. They are adaptable to many and varied services, including cold or hot water circulation, boiler feeding, pressure boosting, refrigeration service, washing equipment, air conditioning systems, etc.

Write today for catalog D2-1042 . . . fully describes and illustrates the new ECONOMY SCV Pump.

ECONOMY PUMPS, INC.

1020 WELLER AVE.

HAMILTON . . . . . OHIO

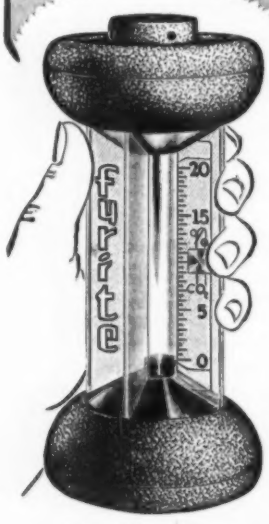
Efficient

FUEL UTILIZATION *SPEEDS* WAR PRODUCTION

FYRITE

CO_2 READINGS

Expose Fuel Waste INSTANTLY!



At Last . . . A PORTABLE "ORSAT"

The amazingly simplified FYRITE "Orsat" Analyzer makes accurate flue gas tests easy—instantly telling you what percentage of your fuel is being wasted. The FYRITE is conveniently held in the hand while analysis is taken. It is accurate within ½ of 1% CO_2; spillproof in any position; rugged, durable, compact. More than 7000 in use.

OXYGEN ANALYZER designed on same principle available soon. Write for particulars.

RETURN COUPON BELOW. *Obtain literature on Fyrite and learn how to get immediate delivery under priority regulations.*

$18.50 COMPLETE WITH INDUSTRIAL TYPE FLUE FILTER

BACHARACH
Industrial Instrument Co.
7000 BENNETT ST.
PITTSBURGH, PA.

SEND BUL. 338 on *FYRITE "ORSAT"*

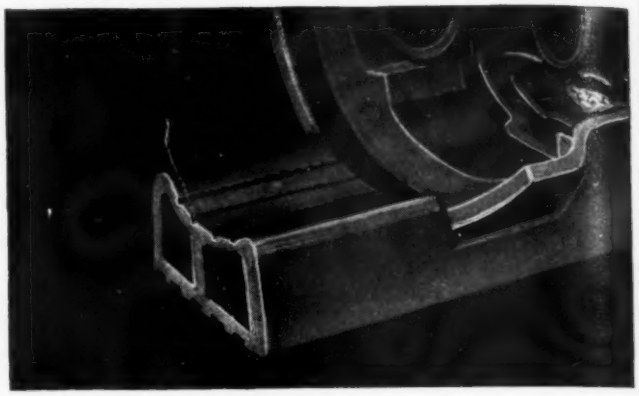
Name

Address

City State P

ADSCO BANNON TILE CONDUIT

Is designed with a **BASE DRAIN**



ONE FAILURE OF A PIPE CONDUIT WITHOUT BASE DRAIN MAY FLOOD ITS ENTIRE LENGTH

The base drain in ADSCO-Bannon Tile Conduit carries away ground seepage water — keeps insulation dry — prevents undue heat loss — prolongs life of the piping.

This strong vitrified tile conduit in combination with ADSCO Filler Insulation — a "Fiberglas" product — provides a permanent installation of high thermal efficiency.

Made of non-critical materials — prompt shipments. Send us details of proposed installation for quotation or ask for bulletin No. 35-67PR.

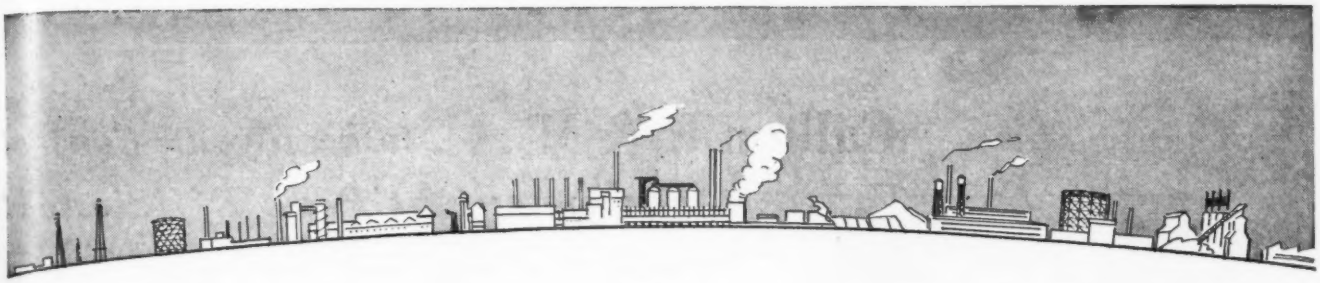
AMERICAN DISTRICT STEAM COMPANY

N. TONAWANDA, N. Y.

MAKING "UP-TO-DATE" STEAM LINE EQUIPMENT FOR OVER 60 YEARS.

EASY TO INSTALL GROUP OF PIPES

Split tile construction. Pipe can be worked on where you can get at it, then let down in place. No working in close quarters. Highly skilled labor not required.



LISTENING IN ON INDUSTRIAL AMERICA

WITH "ears" as big as those of a listening post at the battle front we are catching sounds of a stirring, restlessly active industry—the sounds of plan making for the world stimulating changes of the coming post war era.

New processes, new materials and new equipment are already being developed and perfected to provide for a far higher standard of living. Many of these will be out-growths of developments born of war's necessities in which specialized refractories by Carborundum have played such an important part.

Take synthetic rubber for example. In certain processes "Carbofrax," with its high refractoriness, low spalling tendency and high thermal conductivity has helped to make higher production possible.

The unusual properties of "Carbofrax" are likewise utilized to excellent advantage in the manufacture of some of the materials required in synthetic rubber products to give them the desired characteristics.

In one method by which magnesium is produced, the highly corrosion resistant refractory "Monofrax" plays a vital role. Another magnesium process requires the use of "Carbofrax" because of its high strength at elevated temperatures and rapid heat conductivity.

In the production of zinc and molybdenum the unique properties of "Carbofrax" are again of tremendous importance in increasing output—reducing operating costs.

Thus, it is by no means surprising that we have our ears tuned to the plans for tomorrow—listening for word of new processes in which the use of Carborundum Brand Super-Refractories will undoubtedly prove of great value.

If your process—either present or planned—presents a refractory problem, we would welcome an opportunity of discussing it with you.

CARBORUNDUM

THE CARBORUNDUM COMPANY • **PERTH AMBOY, N. J.**

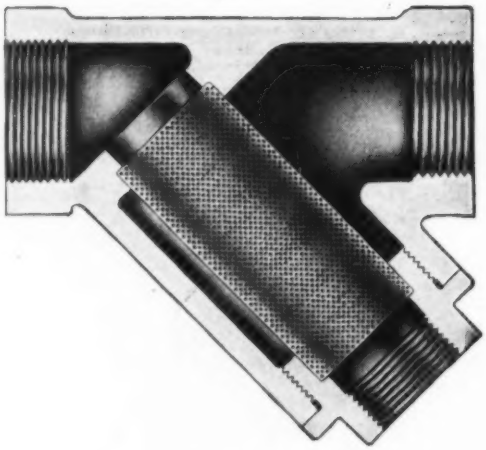
REG. U. S. PAT. OFF.

Refractory Division

District Sales Branches: Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh. Distributors: McConnell Sales and Engineering Corporation, Birmingham, Ala.; Christy Firebrick Company, St. Louis, Mo.; Harrison & Company, Salt Lake City, Utah; Pacific Abrasive Supply Company, Los Angeles, San Francisco, Calif.; Denver Fire Clay Company, El Paso, Texas; Smith-Sharpe Company, Minneapolis, Minn.

(Carborundum, Carbofrax and Monofrax are registered trade-marks of and indicate manufacture by The Carborundum Company)

Call on K & M . . . *to keep your Control Equipment at Peak Efficiency!*



Our entire manufacturing output has gone to war . . . but 65 years of know-how is here to help you. If you have a pressure or fluid control problem—*any kind* of an installation, operating or maintenance problem—*call on K & M.* Our new VALVE PROBLEMS CLINIC is a clearing house of information established to keep your machinery going. There is no charge for this service. You needn't be using K & M equipment. But you have a job to do . . . and we want to *help* you do it, with specific, informative, resultful assistance.

K & M STRAINERS—"Y" and Basket Types for use on steam, water, gas, air, oil and other fluids. Note the oversized strainer basket area to assure minimum pressure loss. Baskets are easily accessible for cleaning. These features are typical of the simplicity and efficiency of K & M design.

KM · KIELEY · ESTABLISHED 1879 · MUELLER

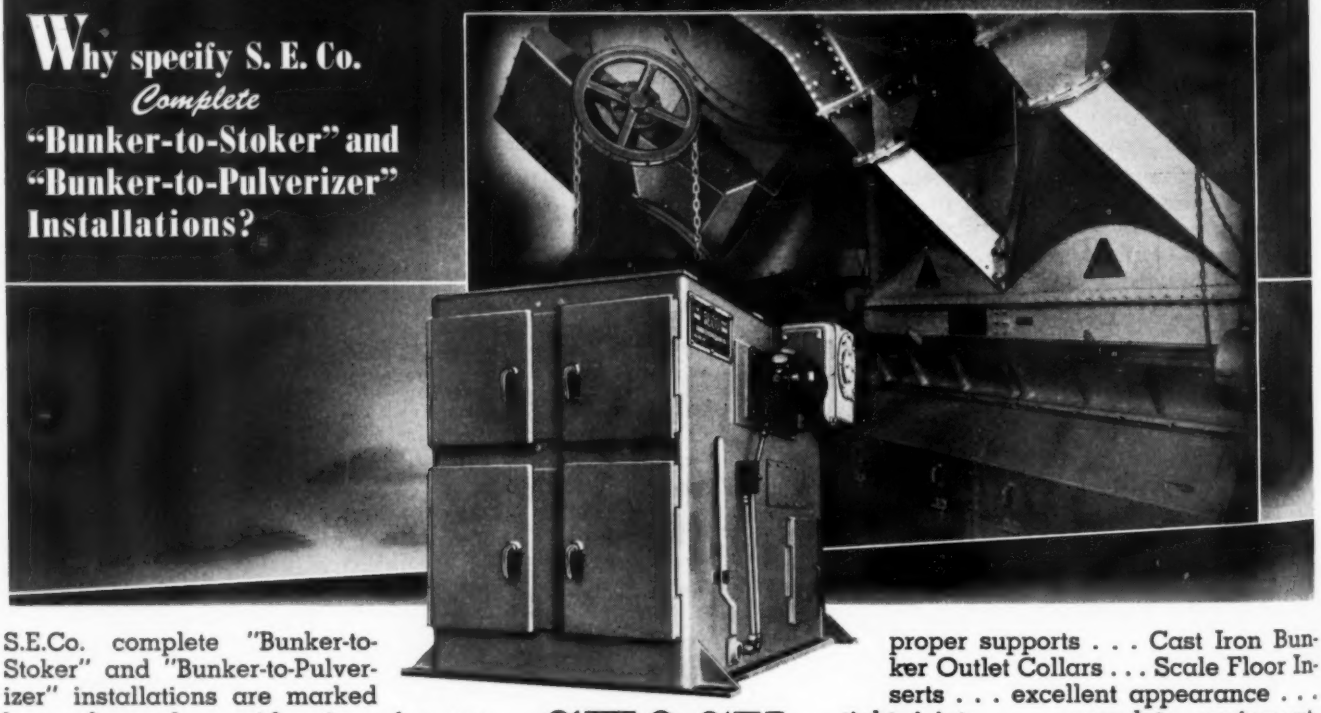
Kieley & Mueller

ENGINEERED PRESSURE & FLUID CONTROL SPECIALTIES

NORTH BERGEN, NEW JERSEY

Representatives in all Principal Cities

Why specify S. E. Co. *Complete* **"Bunker-to-Stoker" and "Bunker-to-Pulverizer" Installations?**



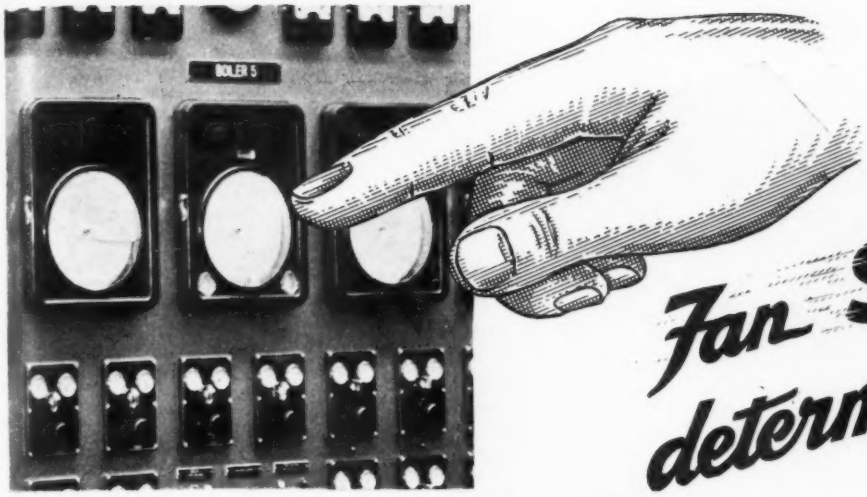
S.E.Co. complete "Bunker-to-Stoker" and "Bunker-to-Pulverizer" installations are marked by a thorough consideration of every detail of design . . . dust-proof . . . freedom from coal sticking . . . no coal segregation . . . heavy construction . . . proper supports . . . Cast Iron Bunker Outlet Collars . . . Scale Floor Inserts . . . excellent appearance . . . tight joints . . . complete equipment. For informative catalogs and bulletins write to Stock Engineering Company, 9807 Theodore Avenue, Cleveland, Ohio.

CONICAL Non-Segregating Coal Distributors

STOCK

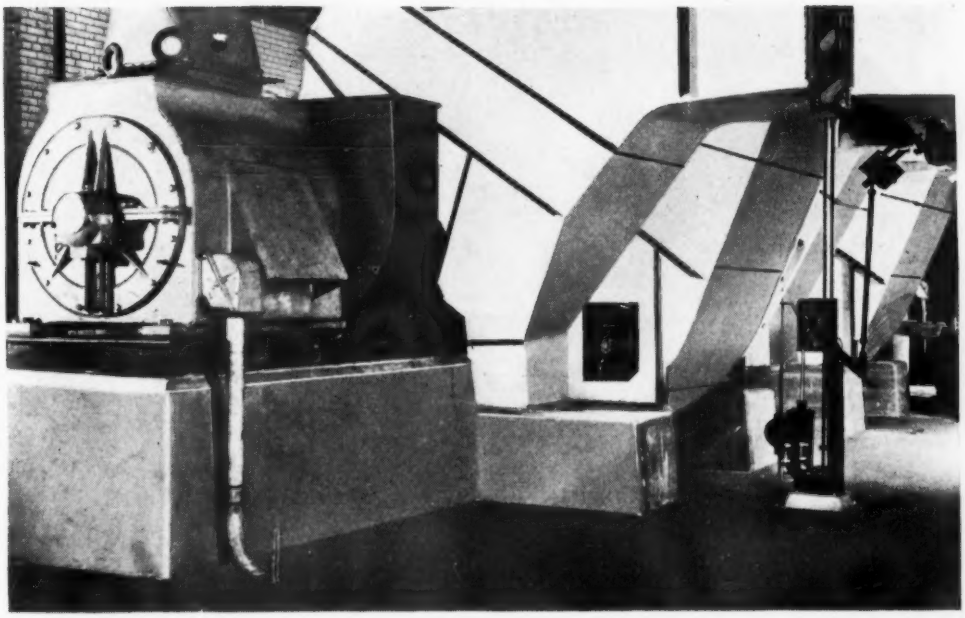
ENGINEERING CO.

S.E.Co. Coal Valves and Coal Scales



Fan SPEED is determined here-

. . with "Buffalo" INDUCED DRAFT FANS (with Variable Speed Drive)



From every angle, it's sound engineering logic to employ the boiler pressure gauge as the "control" for fan speed. That means the fan runs only at the speed necessary to carry boiler ratings, with resultant *and important* saving of rotors and housings as well as power. Check into performance facts of Buffalo Induced Draft Fans with Variable Speed Drive—now serving some of the nation's leading power plants. Buffalo installations are providing greater draft efficiency, minimizing expense and delays of replacements . . . contributing to dependable delivery of power for Industry's wartime needs.

ARMY E NAVY

BUFFALO FORGE COMPANY

488 BROADWAY — **BUFFALO, N. Y.**

Branch Engineering Offices in Principal Cities — Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

BUFFALO MECHANICAL DRAFT FANS

"Buffalo" INDUCED DRAFT FANS

Cochrane Corporation
3106 N. 17th St., Phila., Pa.

Please send me a copy of your new Publication on Carbite Softeners

Name.....

Position.....

Firm.....

.....

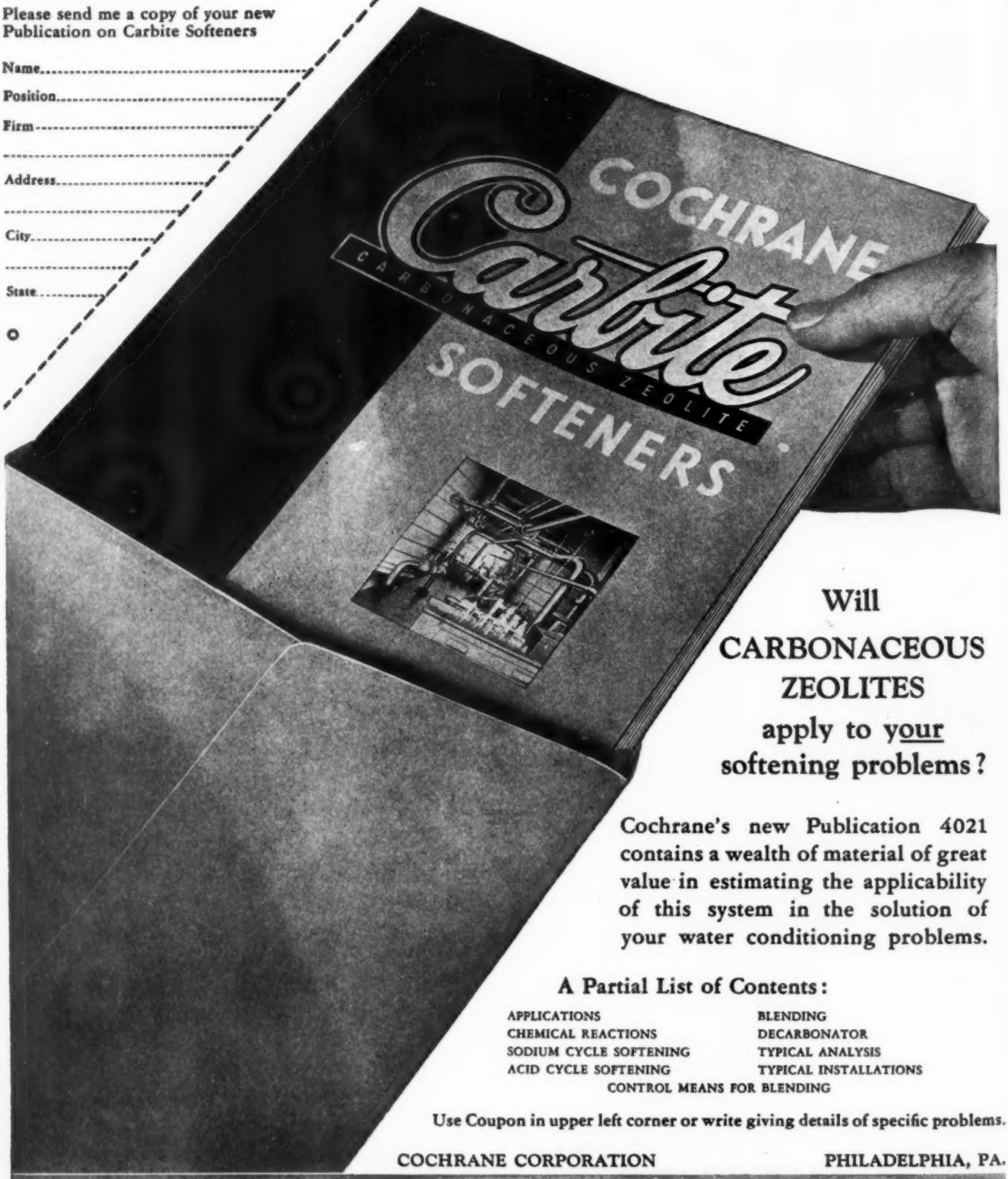
Address.....

.....

City.....

.....

State.....



Will CARBONACEOUS ZEOLITES apply to your softening problems?

Cochrane's new Publication 4021 contains a wealth of material of great value in estimating the applicability of this system in the solution of your water conditioning problems.

A Partial List of Contents:

APPLICATIONS
CHEMICAL REACTIONS
SODIUM CYCLE SOFTENING
ACID CYCLE SOFTENING
BLENDING
DECARBONATOR
TYPICAL ANALYSIS
TYPICAL INSTALLATIONS
CONTROL MEANS FOR BLENDING

Use Coupon in upper left corner or write giving details of specific problems.

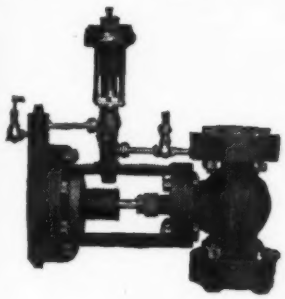
COCHRANE CORPORATION PHILADELPHIA, PA.

COCHRANE

SOFTENERS • DEAERATING SOFTENERS • DEAERATORS • METERS • STEAM SPECIALTIES

Squires CLASS E PUMP GOVERNOR

Is simple in construction and fulfils all conditions required of a pump governor. Real service is expected from every cash outlay for mechanical equipment, and Squires Steam Specialties are a receipt in full for such investments. It's worth your while to inquire about them.

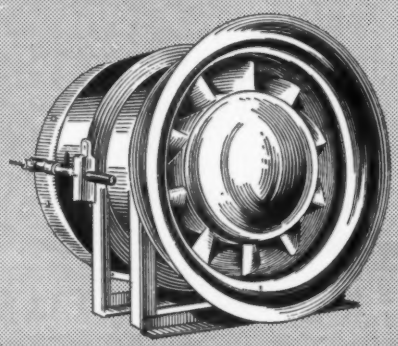


Squires
Class E
Pump
Governor

Described in Catalogue A-11. Sent upon request

The C. E. Squires Company
East 40th St. and Kelley Ave., Cleveland, Ohio

Another WING *Product*



WING AXIAL FLOW BLOWERS
Type EMD (Single Stage)

Used for statics up to 4" with volumes up to 35,000 cfm. Higher capacities can be furnished in special designs. Built-in volume control and re-directing vanes permit simplified capacity variation either manually or automatically. Falling horsepower characteristics with dampering. Motors are constant speed, fully enclosed and dustproof. Static efficiencies up to 70% and more. Uses: Forced draft for oil or gas burners, stokers, pulverized fuel, and hand-fired boilers. Mounted horizontally or vertically; on floor, or directly on windboxes or air preheaters.

L. J. Wing Mfg. Co.
154 West 14th St., New York, N. Y. — Factories: Newark, N. J.

Throughout the New Synthetic Rubber Plant at INSTITUTE, too

WESTON

All-Metal

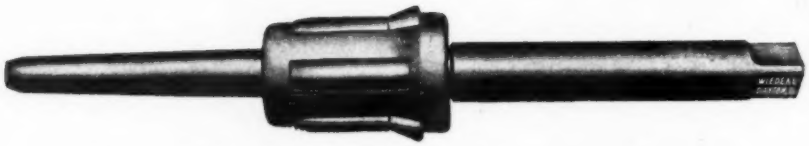
TEMPERATURE GAUGES

are used to insure dependable indications of critical temperatures

Made of enduring metals...minus liquids, gases or fragile elements . . . the WESTON temperature gauge is far more rugged, more readable, and maintains its high accuracy far longer. Weston Electrical Instrument Corp., 679 Frelinghuysen Ave., Newark 5, N. J.

WESTON *All-Metal* TEMPERATURE GAUGES

IDEAL TUBE EXPANDERS

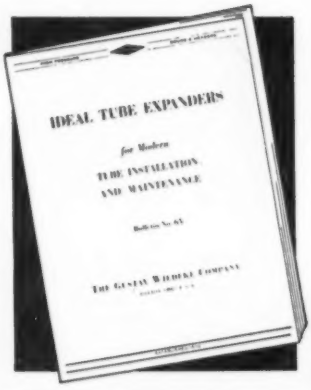


SERIES NO. 1500 IDEAL ROLLER TUBE EXPANDERS

- For rolling and flaring heavy wall tubes in most types of Modern Water Tube Boilers, Economizers, Superheaters and Water Walls.

They can be used with Mandrels for rolling in Drums, Mandrels for through rolling in Headers, and set of Short Mandrels for Angle Rolling.

These Tube Expanders can be furnished with proper length rolls to suit individual requirements.



Write for IDEAL BULLETIN NO. 65 and IDEAL CATALOG NO. 57

The Gustav Wiedeke Company

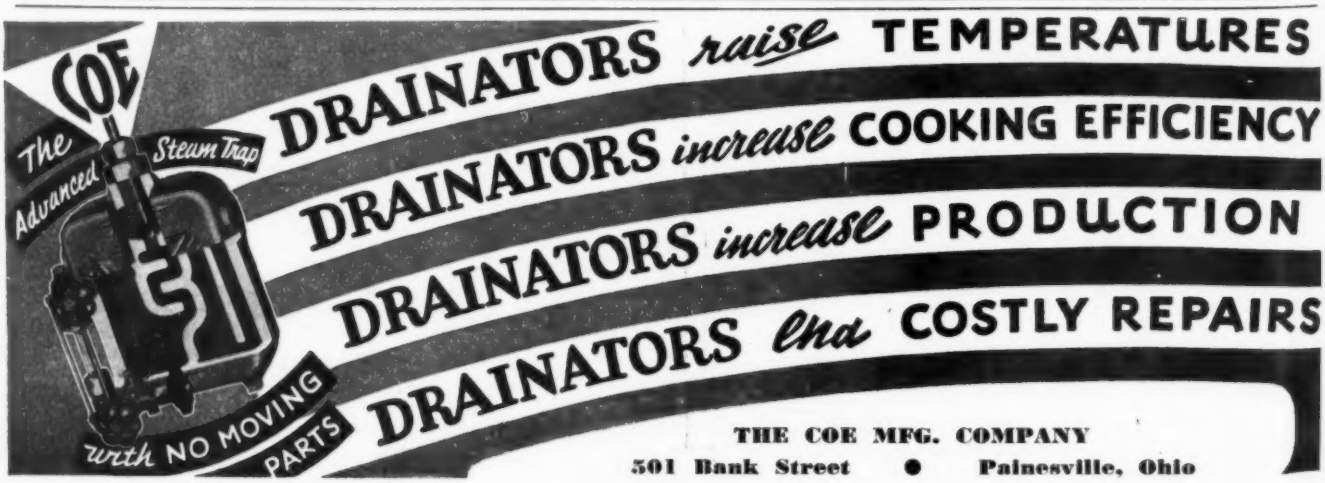
DAYTON 1, OHIO • U.S.A.

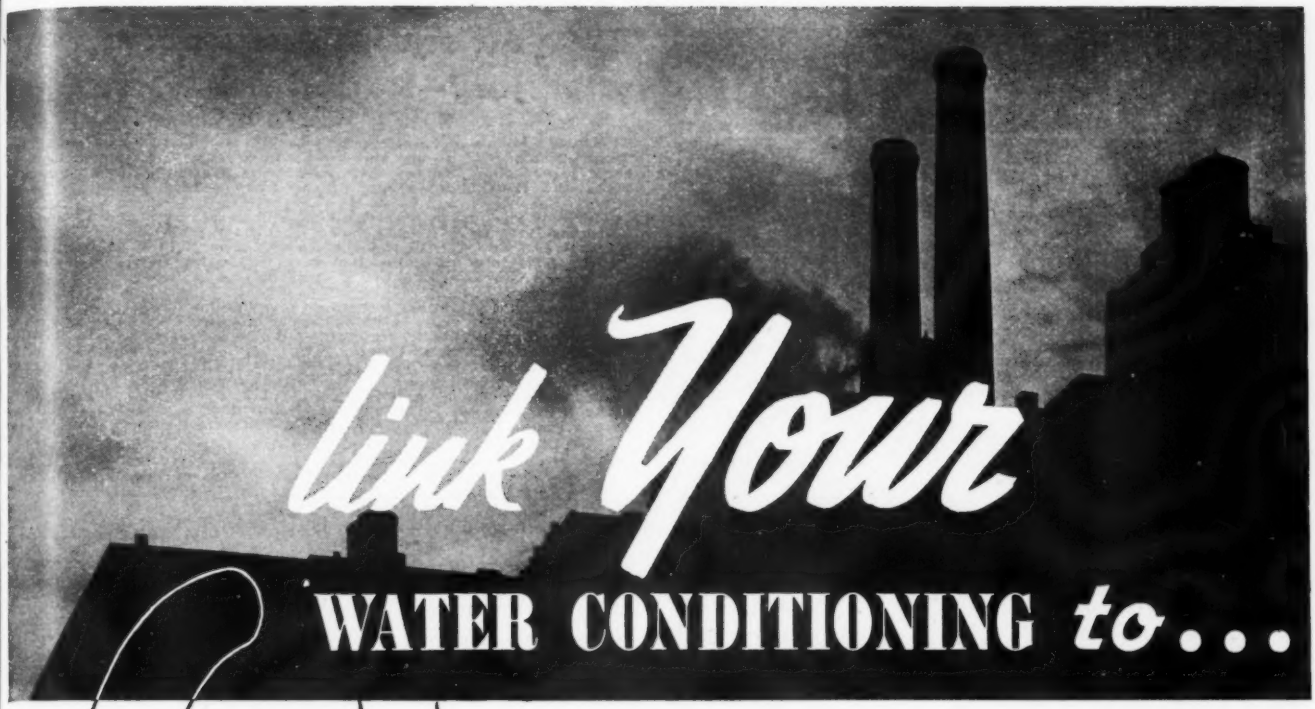
BROWNELL BOILERS

For 85 years this company has been making good boilers. We invite comparison on quality, price, and delivery of various types and sizes of fire tube boilers from 3 H. P. to 250 H. P.

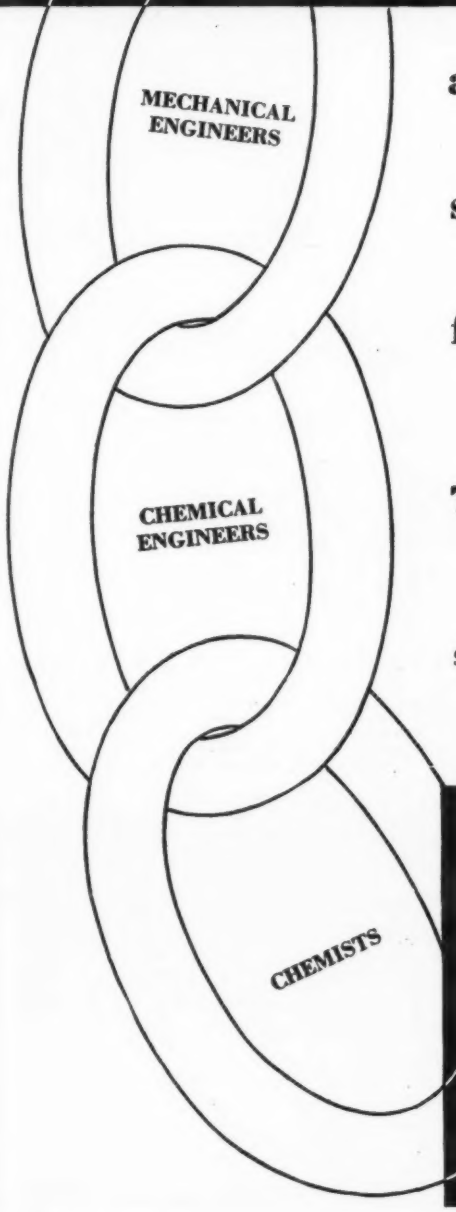
Write us for illustrated bulletins.

THE BROWNELL COMPANY the World Over DAYTON, OHIO, U.S.A.


The COE Advanced Steam Trap
with NO MOVING PARTS
DRAINATORS raise TEMPERATURES
DRAINATORS increase COOKING EFFICIENCY
DRAINATORS increase PRODUCTION
DRAINATORS end COSTLY REPAIRS
THE COE MFG. COMPANY
501 Bank Street • Painesville, Ohio



link Your WATER CONDITIONING to...



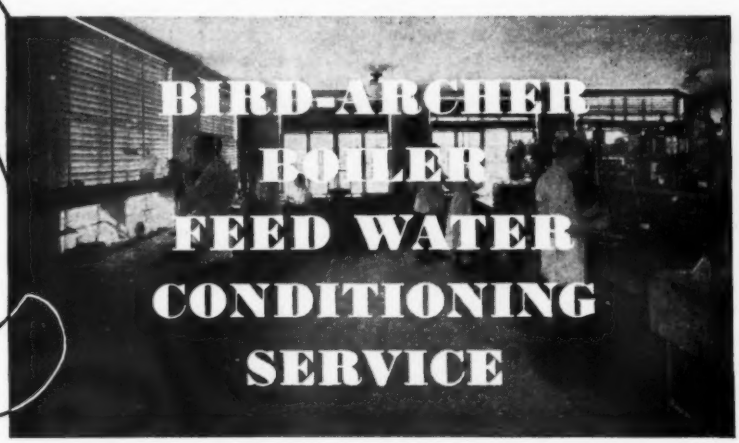
a technical organization which understands *all* water problems and has the facilities to effect an economical solution.

THE BIRD-ARCHER CO.

Chicago New York Philadelphia

★

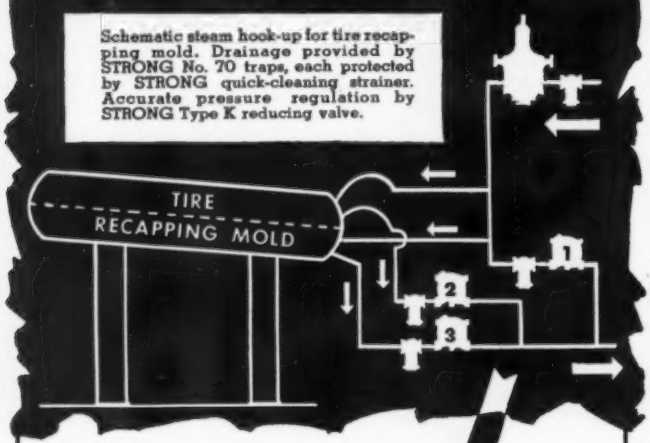
SURVEYS PLANT STUDIES CONSULTATIONS
PLANT DESIGN SUPERVISORY SERVICE
LABORATORY SERVICE TREATMENTS



7-BA-1

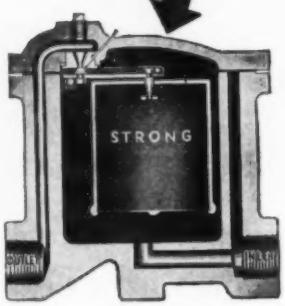
STEAM WORKS HARDER

with the RIGHT TRAPS in the RIGHT PLACES



Schematic steam hook-up for tire recapping mold. Drainage provided by STRONG No. 70 traps, each protected by STRONG quick-cleaning strainer. Accurate pressure regulation by STRONG Type K reducing valve.

On Tire Recapping Units, complete condensate drainage is needed to assure the correct amount of heat at the mold. Three STRONG inverted bucket traps drain the (1) supply line (2) upper mold (3) lower mold.



STRONG 70 Series Trap Semi-Steel—for saturated steam to 150 p. s. i. working pressure.

The condensate rate is low, therefore, the patented STRONG anti-balancing device is valuable in preventing the "dribbling" which causes excessive wear. Strainers ahead of each trap prevent scale and dirt from interfering with operation.

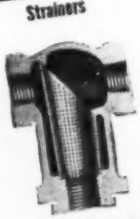
• • •

Completeness of the STRONG lines enables us to recommend exactly the type and size you need—open or inverted bucket, closed float, float-and-thermostatic (blast), etc.—forged, fabricated, (welded), cast and semi-steel construction. Send your problems to Strong, Carlisle & Hammond Company, Cleveland, Ohio.

OTHER STRONG STEAM SPECIALTIES

Reducing Valves

Strainers



Open Bucket Traps

P-343

STRONG

STEAM SPECIALTIES

Are you equipped to hold your job?—to get a new one?

The men who are keeping their jobs today—who are not feeling the whip of competition—are those who have kept one jump ahead of their jobs. They are the men who are equipped with a thorough-going and growing knowledge of the business they are in.

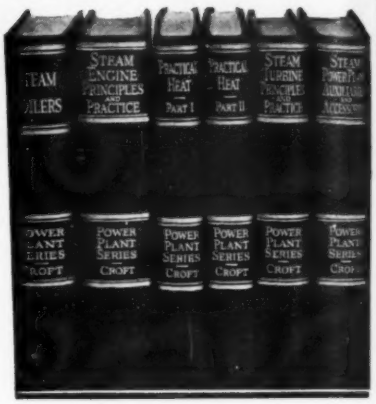
It works in the power plant field as well as in any other. Some men fit themselves to do a little more than their job calls for. They fit themselves to do a little more than the other fellow. They make a steady effort to equip themselves with the best kind of job insurance there is—KNOWLEDGE.

How about you? Do you know how quickly knowledge will pile up—how quickly you will become more valuable—if you spend a few minutes a day, regularly studying sound books like the McGraw-Hill Library of Power Plant Practice? Do you know how easily it can be managed, paying only a few cents a day, while you use the books?

Thousands of men have followed this plan to win advancement or to make their jobs safe. You can too. Read about this Library and our Free Examination Offer. Then send the attached coupon to us today.

POWER PLANT PRACTICE

(6 volumes—2,477 pages, 2,404 illustrations)


STEAM ENGINE PRINCIPLES AND PRACTICE
PRACTICAL HEAT — PART I
PRACTICAL HEAT — PART II
STEAM TURBINE PRINCIPLES AND PRACTICE
POWER PLANT SERIES
CROFT

The Library of Power Plant Practice is the standard of the power plant field. It is accurate — it is thorough — it is complete. It is the result of years of experience with power plant problems. The man who has it has the best. The Library covers the whole field—nothing is omitted. The solution of every problem is plainly worded or explained with a clear illustration. The little stickers and the big troublesome problems are all worked out in advance for you. There can be only one result from studying these books a few minutes each day — more money in your pocket.

No books dealing with the work of the power plant man were ever so complete — so authoritative — so practical in text and illustrations as these. The man who puts this set of books into his library can do so knowing that he has the utmost in power plant books—a set that will give him in language he can understand, all the information he needs in order to get ahead in his work.

Easy to Understand

These books are written in everyday easy-to-understand language. They are written to help the man on the job. It is just as if the author were working in the plant by your side and giving you the benefit of his vast knowledge, man to man. There is no bunkum in this Library, nor is it cluttered up with impractical theories. It is a **Power Plant Library** FOR POWER PLANT MEN.

Glance at the titles of the books in the photograph. They will give you an idea of how completely this Library covers **Power Plant Practice.** Here you have all the information necessary to make you indispensable on the job.

See it 10 days—Send no money

Fill in and mail the coupon below and we will send you the six volumes of the Power Plant Library for 10-days' examination. If you decide to keep the books after examining them, just send $2.00 and then $2.00 a month until the total low price of $16.00 has been paid. See the coupon below for details. Send it Now and HOLD THAT JOB!

McGRAW-HILL FREE EXAMINATION COUPON

McGRAW-HILL BOOK CO., INC., 330 West 42nd St., New York, 18.

Ship to me, charges prepaid, the six volumes of the Library of **Power Plant Practice.** If satisfactory, I will send $2.00 in ten days and $2.00 a month until the price of $16.00 has been paid. If not wanted I will return the set to you postpaid. (To insure prompt shipment write plainly and fill in all lines.)

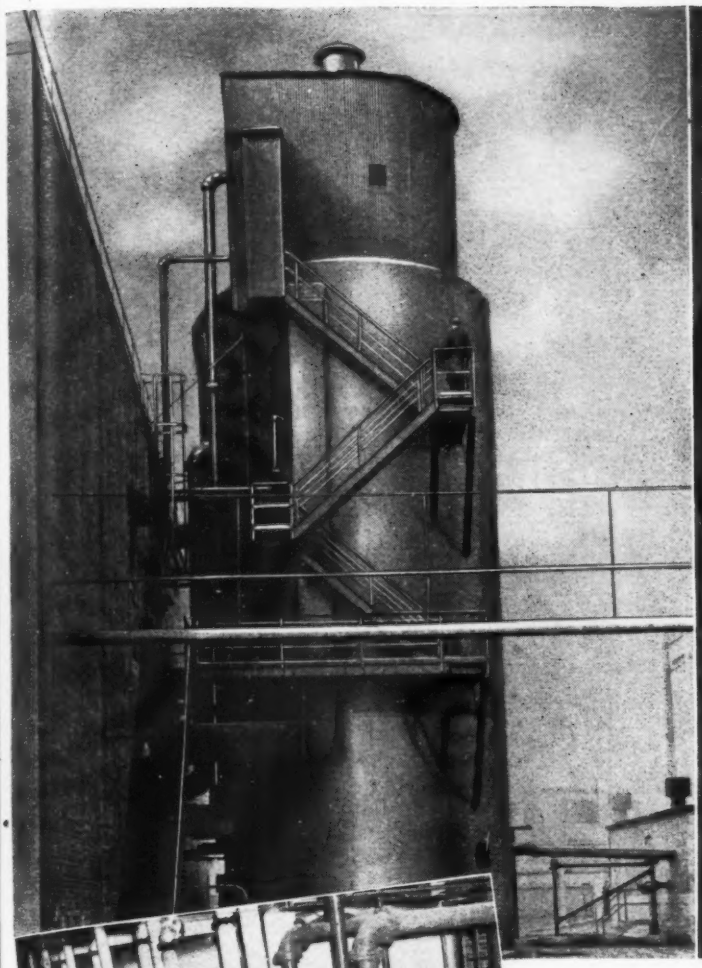
Name .....

Home Address .....

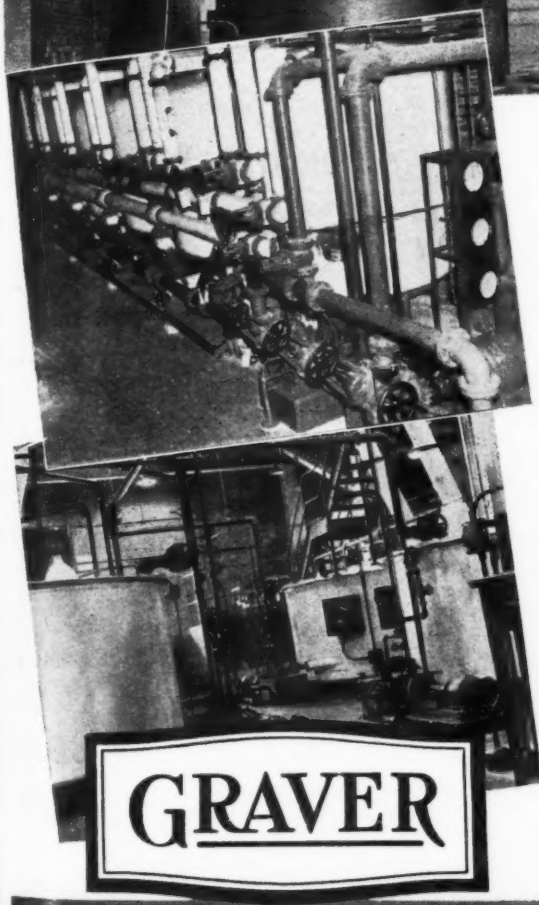
City and State .....

Firm or Employer .....

Position ..... P. 7-43



Designed-Built-Installed by GRAVER



This Graver Hot Process Water Softener and Deaerator is one of two Graver built units, each with a capacity of 60,000 gallons per hour, now serving one of the nation's large ordnance plants. In addition to the Softening and Deaerating unit, the equipment includes six Graver Water Filters, chemical feeders, and a sedimentation tank.

Here is another example of Graver's complete service. The entire equipment was designed by Graver engineers in accordance with specifications of the consulting engineer, built in the Graver East Chicago Plant, and installed by Graver workmen under Graver supervision.

From laboratory analysis to working unit, Graver does the whole job.

Whatever your water conditioning problem may be—consult Graver. There's no obligation.

GRAVER

GRAVER TANK & MFG. CO., INC.

4809-25 Tod Avenue, East Chicago, Ind.

NEW YORK • CATASAUQUA, PA. • CHICAGO • TULSA

Water Conditioning Equipment

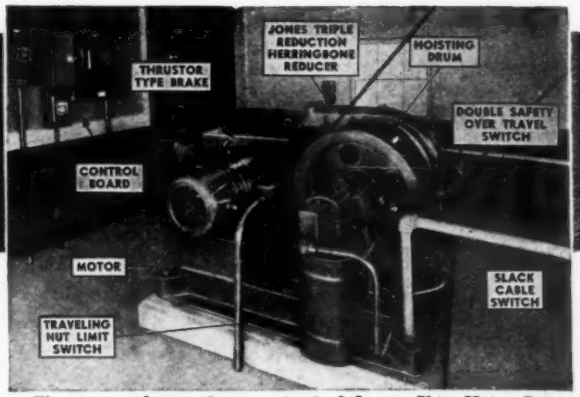
For Economical Material Handling

JONES SKIP HOIST DRIVES

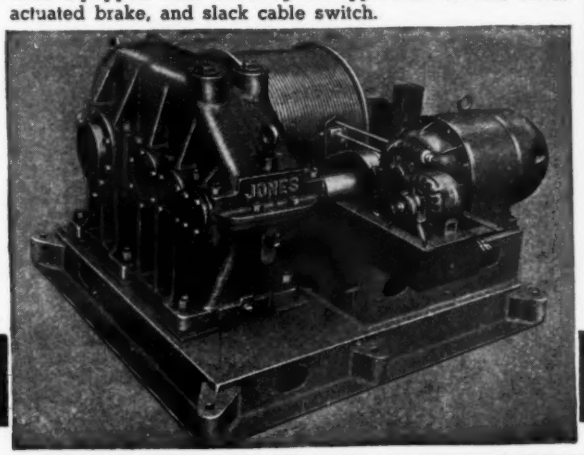
FOR speedy operation, reliable service and over-all economy the Jones Skip Hoist Drive has made a name for itself in a wide variety of material handling service. These skip hoist drives are built as complete units by the Jones organization in several types with base to take any motor specified by the purchaser. They are equipped for all the modern protective devices such as cam or nut type limit switches, solenoid or disc type brakes and slack cable switches. The drives are single, double, or triple reduction Jones Herringbone Speed Reducers, built to stand up under the many years of pounding that a skip hoist drive has to take. The shafts are supported in roller bearings, with rolling action, rack generated gear and pinion teeth to insure easiest possible starting with low starting-peak loads. All reducer bearings and gears are automatic oil-bath lubricated.

The Jones organization has an extensive file of information on skip hoist drive problems and will be pleased to work with you on any problems involving such applications

W. A. JONES FOUNDRY & MACHINE CO.
4423 Roosevelt Road, Chicago, Illinois



• The view above shows a typical Jones Skip Hoist Drive installation while the view below shows one of the Jones units equipped with traveling nut type limit switch, motor actuated brake, and slack cable switch.



Jones HERRINGBONE—WORM—SPUR—GEAR SPEED REDUCERS
CUT AND MOLDED TOOTH GEARS • V-BELT SHEAVES
ANTI-FRICTION PILLOW BLOCKS • PULLEYS
FRICTION CLUTCHES • TRANSMISSION APPLIANCES

This is 1943 A year so different for all of us. A change in living, in habits, in lifelong customs. Ration coupons; not dollars, now buy the gasoline, steaks, shoes. Industry and manufacturing have their alphabetical program to follow. It's a far cry from our former methods to the way business is conducted in 1943.

INDUSTRIAL RUBBER PRODUCTS

The Rubber Industry has been forced to make many changes. Its achievements have been marvelous and ranks high with the progress made by any Industry. Since the call came, unbelievable quantities of Belting, Hose, and Packings have been made and supplied to Uncle Sam, a production feat unequalled by any other Industry.

QUAKER

is playing an important part to

GOVERNMENT • WAR PLANTS • INDUSTRY

Quaker has been right in step with changing conditions. Quaker is supplying large quantities of Belting, Hose, Packings and miscellaneous Moulded items to the Government and plants on war work. But, Quaker has been able to keep some Industrial Rubber Goods moving to those having an essential need for these critical products. It is our purpose to continue to do so.

FAITH and COURAGE

Must be Maintained

Some day . . . may it be soon . . . the conditions of today will change for the better. While they continue, all must keep faith; looking forward to the best, while preparing for the worst and having courage to take what comes until final VICTORY DAY is ours.

QUAKER

is looking to the future with confidence. Industrial Rubber Products are essential to our way of life. When peace time comes, Quaker will quickly adjust production to fill the vast needs of a civilian demand.

MAY THAT DAY BE SOON

Buy More War Bonds and Stamps

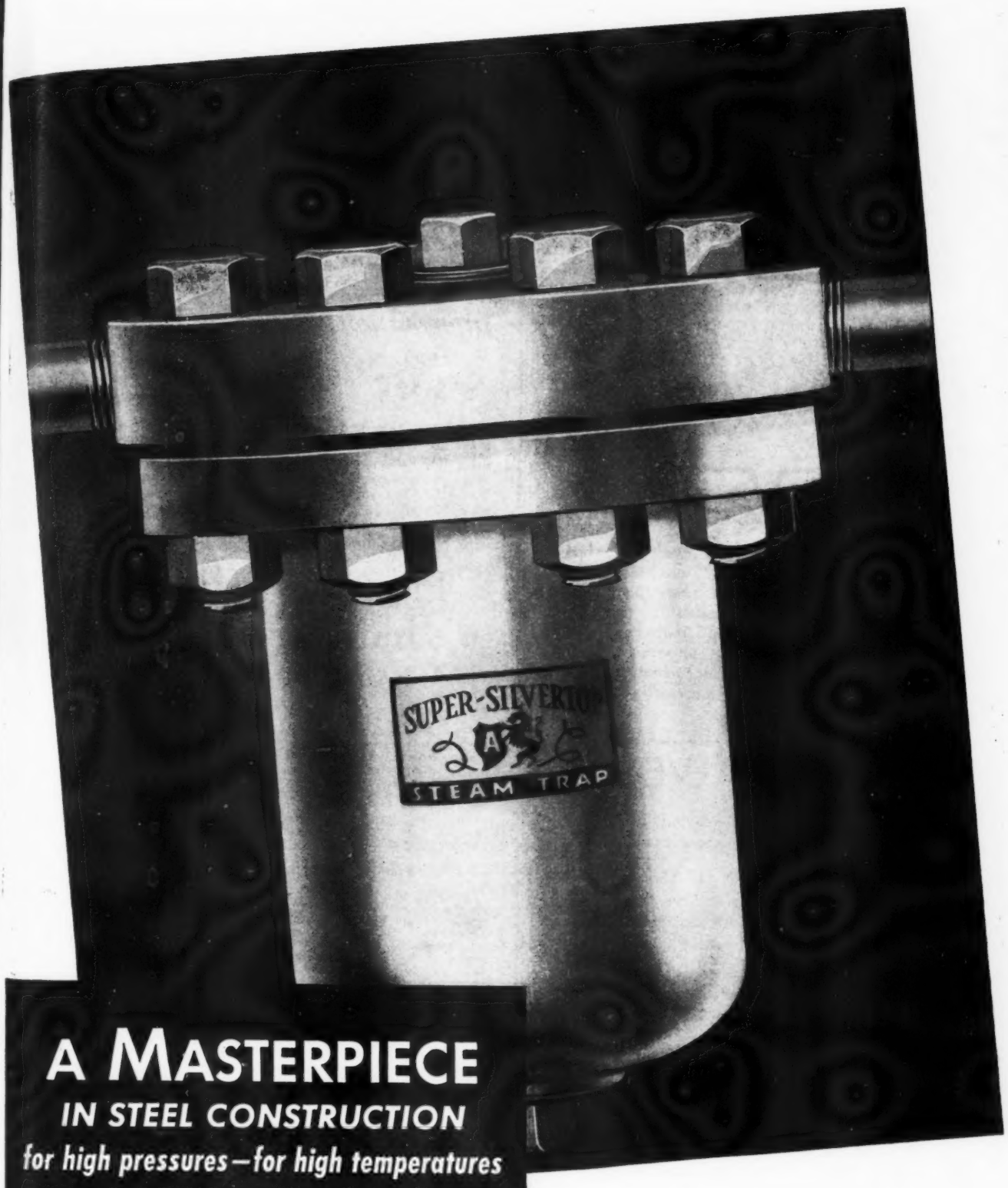
QUAKER RUBBER CORPORATION

PHILADELPHIA • *NEW YORK* • *CHICAGO* • *HOUSTON*

Western Territory

QUAKER PACIFIC RUBBER COMPANY • San Francisco • Los Angeles

REG. U.S. PAT. OFF.



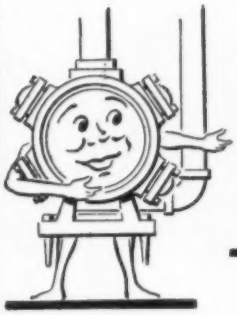
A MASTERPIECE

IN STEEL CONSTRUCTION

for high pressures—for high temperatures

THIS Super-Silvertop Steam Trap for high pressures and temperatures is a masterpiece in steel construction. Its valve and seat are of special chrome nickel alloy, and all internal parts are of stainless steel. It is so complete that it can be installed without buying any extra, expensive fittings; without bending any pipe, or installing or making up extra pipe joints. Its connections are in the top so that it can be installed straight-in-line as shown above, or used as an elbow—in either case only two threaded joints are required. Its gasket joint is recessed to prevent blow-outs. The book "How To Choose a Steam Trap" tells you all you want to know about this steel masterpiece. Send for it today.

THE V. D. ANDERSON COMPANY
1934 West 96th Street • Cleveland, Ohio



IS YOUR COMPRESSOR PROUD OF YOU?

Sure is—and for Good Reason! But honest, all I did was give her

J. H. H. VOSS VALVES
REG. U.S. PAT. OFF.

Well you know how it is, there we had that well built compressor, a good strong frame, heavy shaft, well proportioned fly wheel, big bearings and good size crank and wrist pins, forged steel connecting rod, finely ground piston rod on metallic packing, well fitting piston rings in a true, smooth bore cylinder and a force feed lubrication system, all in A-1 condition. Still she lagged in production until we fitted her with

J. H. H. VOSS VALVES
REG. U.S. PAT. OFF.

There is the *springing point*, proving in case after case that those well built compressors willingly spring into lively action with VOSS VALVES which bring to them that one and only means to do their very best under all operating conditions year in and year out.

To wit—a copy of a letter from Hoboken*

February 16, 1943

"It affords us great pleasure to write you that the Voss Valves with which we equipped our 15" x 12" compressor in 1929, have given us excellent service during the entire time and we are highly satisfied with their performance.

**Name on request.*

For estimates send samples or sketches of your old poppet or plate valves, give bore, stroke and speed of your compressors.

J. H. H. VOSS CO.
785 East 144 Street, New York City

Every phase of electrical maintenance and repair work covered in this Library

5 volumes of practical how-to-do-it information

Every man concerned with the care and repair of electrical machinery should have these practical books, with their helpful tables, diagrams, data, methods and kinks. Every one of the five volumes is jammed to the covers with sound, how-to-do-it information—the kind you have to have when anything goes wrong. Liberal use has been made of practical data and practice in repair shops so as to combine the good features of a library of methods with handbook information covering these methods.

Electrical Maintenance and Repair Library

5 volumes—2042 pages—1721 illustrations

IN these books will be found answers to practically all the repair and winding problems that the electrician will meet in actual practice. The books discuss direct and alternating current windings—repair shop methods for rewinding armatures—commutator connection—the testing of armature windings—the testing of induction motors for faults—practical way of reconnecting induction motors—commutator repairs—correct brush troubles, etc. They tell you how to inspect and repair motor starters and generators—how to diagnose motor and generator troubles—how to figure new windings for old cores on induction motors. You learn about three-wire systems, starting rheostats, transformers and starting polyphase motors, etc. They give you scores of practical methods used by electrical repairmen to solve special problems.

Includes trouble-shooting and repair book

Now, in addition to four well-known practical books on all details of testing, connecting, rewinding, installing and maintaining electrical machinery, the Library of Electrical Maintenance and Repair includes Stafford's *Troubles of Electrical Equipment*, a handy book full of helpful maintenance information, special trouble-shooting charts, explanation of symptoms and causes of machinery troubles, specific remedies, etc. This revised library helps you to know the why as well as the how of electrical maintenance and repair work, gives you the ability to handle bigger jobs with surety of results.

10 Days' Examination—Easy Monthly Payments

You can secure the use of these five great books on electrical repair work for *ten days' examination*. When you have seen for yourself what these books are and how much they can help you, send us your first remittance. The balance may be paid in monthly installments of $2.00 until the price of the library is paid. Send for the books today. Fill in and mail the On-approval Coupon.

McGRAW-HILL FREE EXAMINATION COUPON

McGRAW-HILL BOOK COMPANY, INC., 330 West 42nd St., New York 18, N.Y.

Send me the Electrical Maintenance and Repair Library (5 vols.) postpaid for 10 days' examination. Within 10 days of receipt I will send $1.00, and $2.00 monthly until $15.00 is paid, or return the books postpaid.

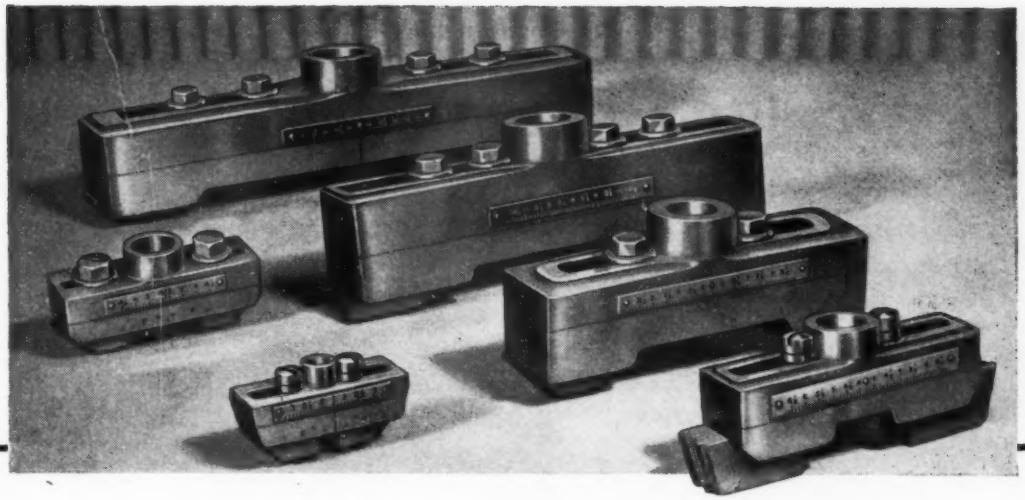
Name .....

Address .....

City and State .....

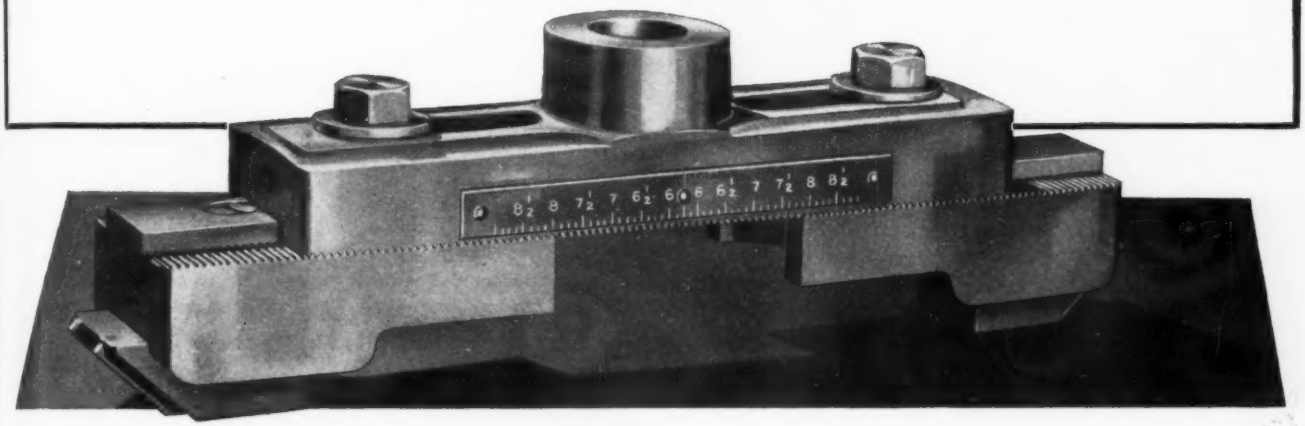
Position .....

Company ..... P. 7-43



NEW DEXTER CUTTERS

AVAILABLE FOR ANY DEXTER VALVE RESEATING EQUIPMENT NOW IN USE



...will completely cover any seat variations
...cut any seat material

The Leavitt Machine Company announces *new-type* cutters and cutter inserts, all of which are available for any Dexter Valve Reseating Equipment now in use . . . all of which have passed tests under every type of condition.

Summed up, here are three important things to remember about this new Dexter Equipment:

(1) The adjustable cutters will adequately cover completely *all* seat variations.

(2) The interchangeable cutter inserts will handle *any* seat angles.

(3) The Tantalum Carbide Tipped inserts will cut *any* seat material.

The cutters are furnished in combinations . . . one combination for all flat seats; other combinations for 45°, 55°, and 75° angle seats. Cutters for reseating seats in 2″ valves and larger are of the adjustable type provided with interchangeable inserts for the different size valves and angles encountered. Cutters for seats in smaller than 2″ valves are covered by our multiple type suitable for reseating the seats of more than one type or size of valve.

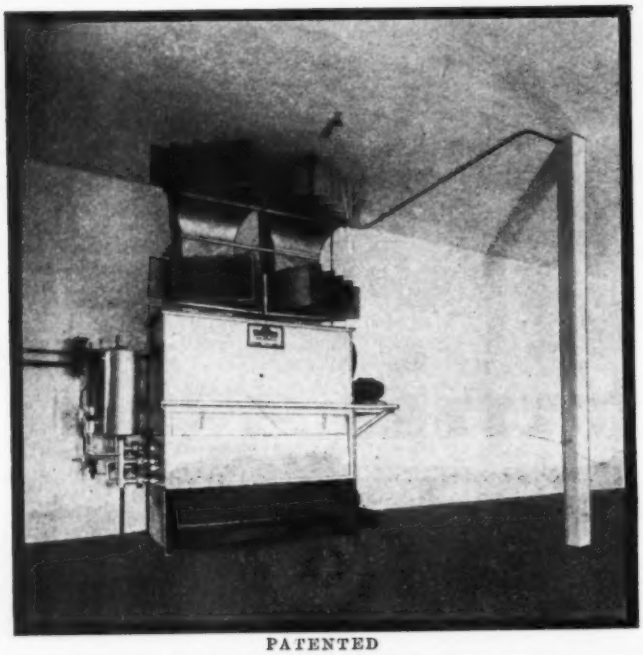
For further information about Dexter Valve Reseating Equipment or the new Dexter Cutters write:

LEAVITT MACHINE COMPANY, Orange, Mass.

DEXTER

Valve Reseating Equipment

INCREASE YOUR PRESENT REFRIGERATION CAPACITY WITHOUT ADDING COMPRESSORS



PATENTED

● The NIAGARA "No-Frost" Method eliminates the progressive icing of refrigeration coils with the attendant loss of refrigeration. It enables you to refrigerate additional space without adding to compressor load —or to save power in present operation.

In addition, the Niagara DUO-PASS AERO CONDENSER increases refrigeration capacity by reducing head pressures. This has been proved by users' power costs reduced as much as 35% when the use of refrigeration capacity was not increased.

Save power and money, or increase refrigerated space by using these machines. For ample assurance of these benefits write for information on users' experience and for Niagara Bulletins 83, 91 and 95. Dept. P-73

NIAGARA BLOWER COMPANY

General Sales Office: 6 E. 45th Street, New York City

37 W. Van Buren St., Chicago — Fourth & Cherry Bldg. Seattle

District Engineers in Principal Cities

NIAGARA INDUSTRIAL COOLING • HEATING • DRYING HUMIDIFYING • AIR ENGINEERING EQUIPMENT

YARWAY GUN-PAKT EXPANSION JOINT

It is packed under full steam pressure. By the turn of a wrench, integral pressure guns force a special semi-plastic packing into the stuffing box.

Welded Steel Construction. Alemite lubricated cylinder-guided sleeve. Made also in conventional gland-pakt types. Write for Bulletin EJ-1908.

•

YARNALL-WARING COMPANY

100 Mermaid Ave. PHILADELPHIA

Mathematics made plain—and easy-to-learn—and amusing!

That is the purpose, completely realized, of this new mathematics text. The authors begin (with a humorous story) right on the edge of the Unknown where arithmetic can no longer show the way. The style is light, the explanations are detailed and the book makes highly interesting reading.

LIVING MATHEMATICS

By R. S. Underwood and Fred W. Sparks, Texas Technological College

365 pages, 6 x 9, $3.00

Here is just the book for: Those who have met with initial failure in trying to master the intricacies of the subject, and those who took to it readily when first presented and now wish to pick up the threads and go on to higher mathematics—the calculus and number theory. In this book you will find drama, zest, humor, surprise, challenge and human interest.

Mail this coupon for

10 DAYS' FREE EXAMINATION

McGraw-Hill Book Co., 330 W. 42nd St., N. Y. C.

Send me Underwood and Sparks' Living Mathematics for 10 days' examination on approval. In 10 days I will send $3.00, plus few cents postage, or return book postpaid. (Postage paid on orders accompanied by remittance.)

Name .....

Address .....

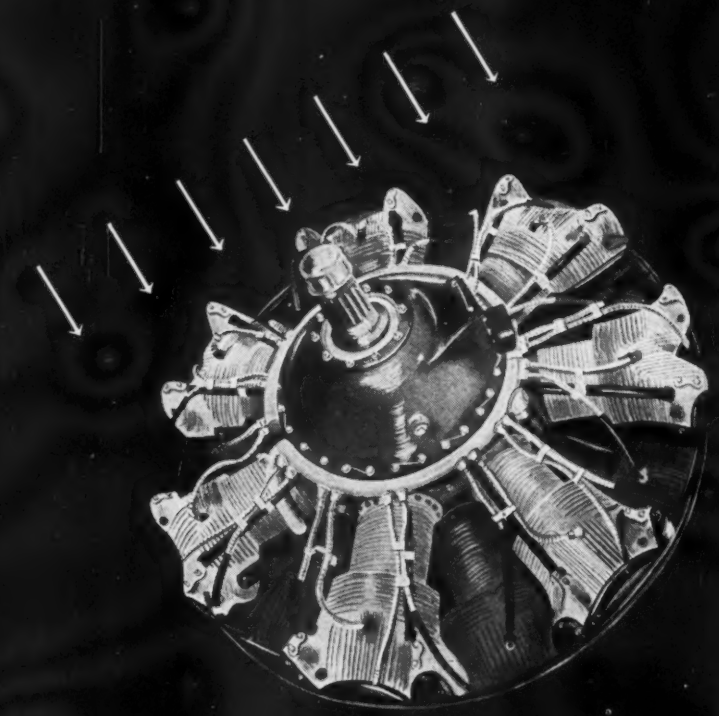
City and State .....

Position .....

Company FP-7-43

(Books sent on approval in U. S. and Canada only.)

PROBLEM: To increase quality and production in acres of factory space



SOLUTION: Cooling 17,000,000 gallons of water daily

• "Air conditioning by the acre." That was literally the challenge presented by the production requirements of a huge new plant of Wright Aeronautical Corporation.

Carrier's contribution is one of the largest single centrifugal refrigeration installations ever made. Composed of five Carrier Centrifugal Machines utilizing steam from the boilers of the heating plant, the refrigeration plant has a total capacity of 6,000 tons of cooling. 12,000 gallons of water per minute are cooled to 47° F. and distributed through coils to the main manufacturing area and office building.

Here in one of the aviation industry's largest engine factories, famous Wright Cyclone Engines are being made under conditions that enable continuous production.

Carrier first served the aviation industry in World War I, but air conditioning for greater production from machinery was developed by Carrier engineers even before that time. If you have a war production problem in which precision manufacture, close tolerances, prevention of corrosion are factors—let Carrier help you with equipment to control temperature, humidity and circulation of cleaned air.

CARRIER CORPORATION, Syracuse, N. Y.

Carrier

ARMY E NAVY

AIR CONDITIONING • REFRIGERATION

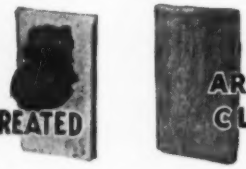
INDUSTRIAL HEATING

FORTY-ONE YEARS EXPERIENCE IN INDUSTRIAL INSTALLATIONS

WHERE TO BUY

Featuring additional products and specialties for power plants

NOT THIS—BUT THIS



Slag adhesions and flame and slag penetrations into fire-walls can now be stopped.

Armor-Clad revolutionary monolithic coatings (not air-set) hermetically seal firewall surfaces, pores and joints: greatly increase refractory life and minimize necessities for taking your boilers

OFF THE FIRING LINE!

Armor-Clad coatings are in use by many of the most important industrial companies of America, U. S. Army and Navy transports, Arsenals, and factories, wherever production facilities must be kept

ON THE FIRING LINE!

Send for free samples and booklet P. It tells the story.

ARMOR-CLAD COMPANY
Emil A. Schroth, Pres.
39 Hyatt Ave., Newark, N. J.

VIBRATAP CLEANER

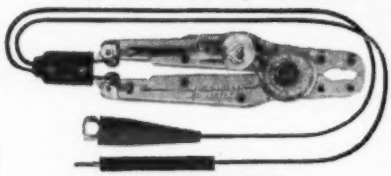
FOR WATER TUBES

Less Fuel—More Power

● For Water and Fire tubes. Rapid Vibration quickly breaks scale's grip on tubes. Special head on water tube type also breaks up scale. Fast work with moderate pressure—big fuel savings! Just try one. Also ask about the Mohawk Power Scraper.

BRUNT EQUIPMENT CO.
60 S. DIVISION ST. BUFFALO, N. Y.

NEW DESIGN
Strong, transparent, plastic carbon test lamp, visible from any direction



TESTS 110-250 VOLTS

Insulated pliers for testing and pulling fuses. Folding prongs fit base plugs. Test cord attachable.
Can be obtained from G.E.—Westinghouse, or other first class jobbers

START TEST POCKET PLIERS
235 Canal St. New York, N. Y.

"MONO" BOILER BAFFLES HIGH TEMPERATURE Refractory Cements

SANFORD C. SMITH REFRACTORIES, INC.
1715 NIAGARA ST., BUFFALO, N. Y.

THE ORIGINAL

Tripp Metallic Packing

TRIPP METALLIC PACKING CO.
BOSTON MASS.

POWERS TEMPERATURE and HUMIDITY CONTROL

Automatic Control

For Industrial Processes, Heating and Air Conditioning Systems, Hot Water Heaters and Shower Baths. Write for Bulletins.
Offices in 47 Cities
2671 Greenview Ave., Chicago, Ill.
THE POWERS REGULATOR CO.

A Good Habit

This "Where to Buy" Section supplements other advertising in this magazine. . . It's a good habit to check this page—every issue.

PROFESSIONAL SERVICES

THE BIRD-ARCHER CO.
Engineers and Consultants on Water Conditioning Problems
Surveys . . . Plant Studies . . . Analyses
400 Madison Ave. New York, N. Y.

HALL LABORATORIES, Inc.
R. E. HALL, Ph.D., Director
CONSULTANTS ON
BOILER WATER CONDITIONING
304 Ross St. Pittsburgh, Pa.

STANLEY ENGINEERING COMPANY
CONSULTING ENGINEERS
Power Plants
Steam - Diesel - Hydro
Design - Construction - Test - Valuation
Central State Bank Bldg., Muscatine, Ia.

COLUMBIA ENGINEERING CORP.
STRUCTURAL, MECHANICAL & ELECTRICAL ENGINEERS
War Plant Design - Supervision of Construction - Engineering Reports
61 Broadway New York, N. Y.
323 Plum Street Cincinnati, Ohio

LANCASTER, ALLWINE & ROMMEL
Patents—Copyrights—Trade Marks
Booklets—General Information Concerning Inventions & Patents and "Free Schedule" sent without obligation.
Established 1915
Suite 456, 815—15th St., N.W., Washington, D. C.

JOHN A. STEVENS, Inc.
Established 1900
CONSULTING ENGINEERS
Power Plants
Dye Houses
Paper Mills
Surveys
Lowell, Massachusetts

H. E. CORL
CONSULTING ENGINEER
Design Supervision of Construction Management
Industrial and Municipal Power Plants
Steam and Diesel
Steam and Electric Power Distribution Systems
Plant Surveys Appraisals Reports
1316 Arch Street Philadelphia, Pa.

SARGENT & LUNDY
ENGINEERS
140 South Dearborn St.
CHICAGO, ILLINOIS

STONE & WEBSTER ENGINEERING CORPORATION
Design and Construction
Reports • Examination • Appraisals
Consulting Engineering
BOSTON • NEW YORK • CHICAGO • HOUSTON
PITTSBURGH • SAN FRANCISCO • LOS ANGELES

GILBERT ASSOCIATES, INC.
ENGINEERS AND CONSULTANTS
Power Plant Design and Construction
Rehabilitation and Maintenance
Steam — Diesel — Hydro
Reports — Examinations — Laboratory
Industrials and Utilities
61 Broadway New York
Reading, Pa.
National Press Bldg. Washington, D. C.

J. E. SIRRINE & COMPANY
Power Plants Design Water
Engineers
Steam Utilization
Consultation Reports Plans
Greenville South Carolina

THE J. G. WHITE ENGINEERING CORPORATION
ENGINEERS—CONSTRUCTORS
New York, N. Y.

IT TAKES ALL KINDS OF TOOLS—TO WIN A WAR

Tools are very important in every enterprise and especially so during war time. It is extremely important therefore that we all conserve vital tools as much as possible. Rather than specifying new "TOLEDOS" at this time we suggest having your present "TOLEDOS" reconditioned and dull dies and cutters resharpened for further service. Your part in conserving vital metals today.

THE TOLEDO PIPE THREADING MACHINE CO. TOLEDO, OHIO

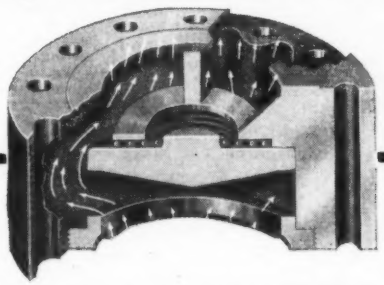
NEW YORK OFFICE, NO. 2 RECTOR ST. BLDG.

"TOLEDO"

TRADE-MARK REGISTERED U.S. PAT. OFF.

BUY WAR BONDS AND WAR STAMPS

WILLIAMS-HAGER
Flanged Silent Check Valves



ASSURE UNINTERRUPTED FLOW

The WILLIAMS-HAGER Silent Check Valve is tight under every condition of service and pressure. Yet it assures unrestricted and uninterrupted flow of liquids—there are no webs to hamper the flow. It will operate in any position and is of rugged, simple, compact design. WILLIAMS-HAGER Silent Check Valves can be built of semi-steel, cast steel, government bronze, stainless steel or monel metal. From 1" to 20" inclusive, pressure-resistant to 6000 pounds, and for all liquids—including oils and chemicals. Write for complete information contained in Catalog No. 142.

The WILLIAMS GAUGE COMPANY

2055 Pennsylvania Ave. Pittsburgh, Pennsylvania

No PIPE JOINT COMPOUND COMPARES with X-PANDO —for ALL USES

Used by U.S. Navy • U.S. Maritime Commission • U.S. Coast Guard • U.S. Army • U.S. Army Air Corps •

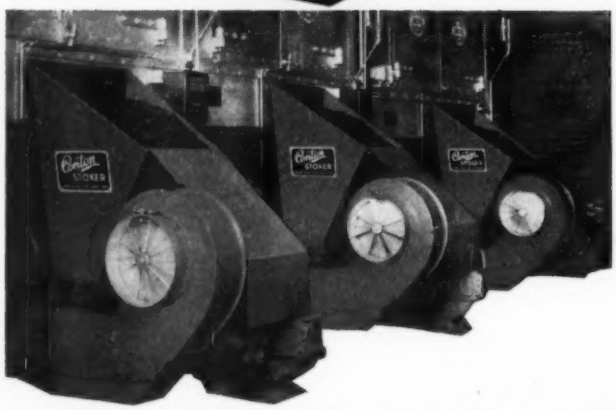
EXPANDS AS IT SETS—one formula for all uses—economical, goes 6 times further—holds anything carried in metal pipe except certain heavy acids—expands and contracts with pipe movement—joints easily taken apart—the expansion corrects imperfect threads—smooths flange faces—withstands deflection, sharp temperature changes—vibration and pressures—better than litharge and glycerine for all uses. The standard compound for industry and shipbuilding.

DISTRIBUTORS EVERYWHERE

X-PANDO CORPORATION

43-15-36th Street Long Island City, N. Y. STillwell 4-7180

DOES THIS *Canton Stoker* INSTALLATION SUGGEST THE ANSWER TO YOUR NEEDS ?



HIGH OPERATING EFFICIENCY AT 200% OF RATING PERMITTED PLANT EXPANSION — NO ADDITIONAL BOILER ROOM EQUIPMENT . . .

MULTIPLE PROBLEM: Limited space to convert from oil to coal stoker firing, plant expansion required increased steam output.

EASY SOLUTION: An unbiased analysis resulted in installation of CANTON Uniflex Ramfeeds. Quickly completed because of Uniflex design—all operations in front: no expensive structural changes, floor level ashpits and front motor mounting. Overratings of 200% easily carried: thus, CANTONS deliver sufficient overload capacities for 24 hour peak load demand. This vital war plant saved critical oil, lowered maintenance and steam costs and eliminated expense for additional equipment. Worth an investigation for your requirements?

HUNDREDS OF "FAMOUS NAME" PLANTS RELY ON CANTONS 54 STOKER TYPES AND SIZES

• To simplify your successful conversion from oil or gas your needs will perhaps be easily met with CANTONS. For today's essential requirements CANTON offers Wormfeed or Ramfeed Stokers engineered for all commercial and industrial uses up to 800 H.P. or more. Prominent organizations like Bell Aircraft Corporation, Republic Steel Corporation, Otis Elevator Company and U. S. Department of Agriculture are only a few of the many who after careful analysis chose CANTONS.

ALL "CANTONS" GUARANTEED 5 YEARS

Only CANTON offers this unusual Bond—the guarantee covers not only defects but wear as well. Additional proof of CANTONS' ruggedness and durability.

SEND TODAY FOR DESCRIPTIVE DATA AND FACTS

CANTON STOKER

CANTON STOKER CORPORATION

741 Andrew Place, Southwest

CANTON, OHIO

Representatives in Principal Cities

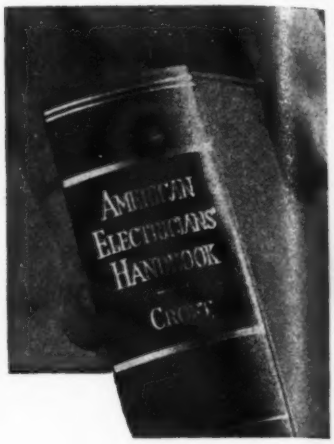
32 YEARS OF "KNOW HOW"

Get the right answer fast . . .

for more efficient profitable handling of

every type of practical electrical job

Tens of thousands of men have used previous editions of this famous handbook with satisfaction, as a working guide of everyday usefulness. Now it is ready to help you too, in a big 5th edition — 600 pages larger than before — brought up to date in every respect — more than ever before the one great pocketbook of practical electricity for you.



Enlarged 5th Edition

Terrell Croft's

AMERICAN ELECTRICIANS' HANDBOOK

This book is packed from cover to cover with the facts which every man engaged in electrical work needs to have constantly at hand. It gives the information you need in the form in which you can use it. From clear explanation of the fundamentals of electricity to suggestions for remedying the troubles of electrical equipment, the information is the kind that helps practical electrical men—wire men, contractors, linemen, plant superintendents, operators, construction engineers, and others—to select and install commercial electrical apparatus and materials intelligently for the performance of specific services. It gives the kind of data that will help them operate electrical equipment efficiently and to maintain it at high operating efficiency.

Revised by

CLIFFORD C. CARR

Head of Electrical Engineering Department, Pratt Institute

1600 pages of

practical data, helpful pointers, explanatory illustrations and diagrams, useful rules, recommendations, and short cuts, and much descriptive information on modern electrical practice. 5x7½, 1177 illustrations, price only

$5.00

10 big sections give you:

—information on all commonly employed electric wires and cables; help in selection of proper type, methods of handling, etc.

—aid in selection and specification of switching, protective, capacitor, and wiring-device equipment, estimating space for switchboards, care of batteries, etc.

—practical data on operation, care, installation, and selection of motors and control equipment; information on planning motor circuits and drives.

—helps on transformers, outside distribution, luminaire equipment; handy wiring tables; etc., etc.

10 DAYS' FREE TRIAL—SEND THIS COUPON TODAY

McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York, 18, N. Y.

Send me Croft's American Electricians' Handbook for 10 days' examination on approval. In 10 days I will send $5.00, plus few cents postage, or return book postpaid. (Postage paid on cash orders; same return privilege.)

Name .....

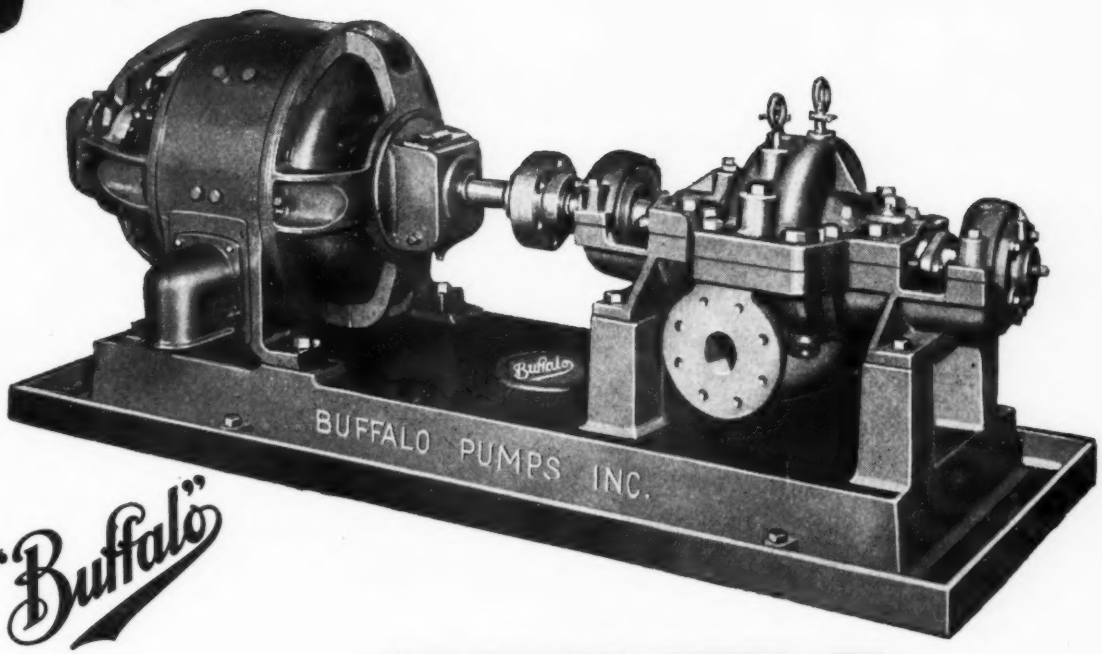
Address .....

City and State .....

Position .....

Company ..... P. 7-43

NO RATIONING OF PERFORMANCE!



"Buffalo"

GENERAL SERVICE PUMPS

Buffalo Pumps are long on service—and short on attention and troublesome maintenance. This full measure of performance—backed by over 60 years of pump-building experience — continues year in, year out to win the praise of practical operating men. Buffalo General Service pumps are designed by experts, constructed by experts, okayed by experts, every Buffalo Pump is efficiently matched to its job—with an extra margin of performance left over!

ARMY E NAVY

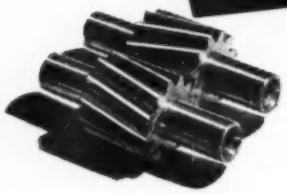
BUFFALO PUMPS, INC.
488 Broadway Buffalo, N. Y.

Branch Engineering Offices in Principal Cities
Canada Pumps, Ltd., Kitchener, Ont.

★ "Buffalo" PUMPS ★

Here's one Reason ROPER PUMPS Last Longer

ONLY 2 MOVING PARTS



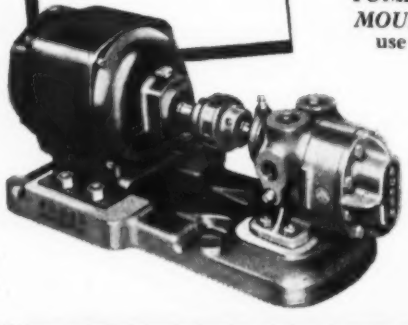
HANDLE ANY LIQUID FROM A TO Z

Alcohol	Molasses
Asphalt	Naphtha
Bilgewater	Olive Oil
Boiler Compound	Paints
Catsup	Peanut Butter
Chocolate	Petroleum
Cresote Oil	Quenching Oils
Drugs	Road Oil
Dyes	Rubber Cement
Essential Oils	Shellac
Fruit Syrups	Soap
Fuel Oil	Syrups
Gasoline	Tarvia
Glue	Tomatoes
Hot Lard	Varnish
Ink	Water
Kerosene	Yeast
Lacquer	Zinc Nitrate
Lubricating Oils	

★ It makes no difference how thin or how thick, a Roper will do the job. Any liquid free from abrasives can be pumped with economy and efficiency.

HYDRAULICALLY BALANCED

THIS SEAL means higher efficiency, quieter operation, greater dependability and longer life.



★ The ROPER PRINCIPLE is the simplest ever designed. It has only two moving parts—EQUAL SIZE PUMPING GEARS operating at same speed.

When this principle was introduced it was the most economical and satisfactory way to move liquid. It was new then—it's new now because any product that does a job in the best way a job can be done is never old.

Over eighty years experience has proved the ROPER PRINCIPLE Basically sound and so absolutely right that nothing could be changed to make it better. Improvements are continually being added to the pump but the principle remains unchanged.

QUICK FACTS

CAPACITIES—1 to 1000 gallons per minute.
PRESSURES—up to 1000 lbs. per square inch.
SPEEDS—up to 1800 revolutions per minute.
BEARINGS—sleeve or roller.
PACKING BOXES—mechanical seal or packed type.
PUMPING GEARS—spiral or spur tooth.
MOUNTINGS AND DRIVES—for any practical use including hand-operated units.

SEND FOR *Free Catalog*

Our new catalog is complete with cutaway views, performance data, dimensions, weights and pertinent engineering information. Write for it today—Catalog 544.

ROPER *Rotary* PUMPS

GEO. D. ROPER CORP., ROCKFORD, ILL.

How You Gain

By Reading POWER Regularly

1. **You strengthen the security in your job . . .**

   By keeping abreast of the field's most up-to-date practices.

2. **You equip yourself for a bigger job . . .**

   By learning through the experience of other engineers important things you don't have a chance to learn in your present job.

3. **You make yourself an authority in your field . . .**

   By constantly accumulating a great store of practical power engineering knowledge that can't be found in books.

Read POWER Carefully

and we guarantee you will get ideas *from every issue* that will more than pay you for the subscription price and the time spent.

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT : "OPPORTUNITIES" : EQUIPMENT
BUSINESS : : USED OR RESALE

UNDISPLAYED ——RATES—— DISPLAYED

10 CENTS A WORD, MINIMUM CHARGE $2.00. *Positions Wanted* (full or part time salaried employment only) ½ the above rates payable in advance.

Box Numbers—Care of publication New York, Chicago or San Francisco offices count as 10 words.

Discount of 10% if full payment is made in advance for 4 consecutive insertions.

Individual Spaces with border rules for prominent display of advertisements.

The advertising rate is $6.30 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.

NEW ADVERTISEMENTS received by July 12th will appear in August issue, subject to limitations of space available P

WANTED

ENGINEERS

MECHANICAL
CHEMICAL
POWER
DRAFTSMEN

A major soap company is enlarging its engineering division to develop designs of projects in plant layout, processing and mechanization of finishing operations for a long-range program.

Opportunity for advancement and permanence for those who can qualify and are not now employed in essential industry at highest skill.

P-553, Power
330 West 42nd St., New York City

OPERATING ENGINEERS — WANTED
Operating engineers who have or have had a Marine Engineers' License. Wages from $300 to $700 per month.
Apply
Local No. 33, M. E. B. A.
227 Fulton Street New York City

WANTED

DRAFTSMEN

Men acquainted with machine layout and process piping. Permanent position in rayon plant located in beautiful section of the southeast. Essential War industry. Applicants please state age, education, previous experience and salary desired; photograph or snapshot not returnable.

American Enka Corporation
Enka, N. C.

POSITIONS VACANT

MECHANICAL ENGINEER or Draftsman capable of designing cast steel and cast iron valves for industrial service. This is an opportunity to join the Engineering Staff of an old established Eastern New York State Valve Manufacturing Company. Applicants without actual valve design experience will not be considered. In reply state experience, age and salary required. P-554, Power, 330 W. 42nd St., New York, N. Y.

SALES ENGINEER For Power Plant Equipment. Preferably graduate chemical or mechanical engineer. Must have knowledge of chemistry as applied to water conditioning. Travelling part of time, Minnesota and vicinity. Deferred classification in draft. Give complete particulars and salary desired in application. P-555, Power, 520 N. Michigan Ave., Chicago, Ill.

BOILER INSPECTOR TRAINEE. Wanted by high class Insurance Company. Technical background desirable; practical experience in operation, maintenance or construction of high-pressure boilers necessary; ability to write comprehensive reports essential. Our employees know of this advertisement. Applicants must be non-essential work or otherwise comply with War Manpower Commission. P-556, Power, 330 W. 42nd St., New York, N. Y.

FIRE PROTECTION ENGINEER and Inspector. Permanent positions open in New York, Pennsylvania, or the Middle West with large industrial fire insurance organization. Previous knowledge in this work not necessary. Applicant must be a technical graduate with manufacturing or engineering experience, and possess a good personality. Send photo with letter. Men subject to draft for military service cannot be considered. P-557, Power, 330 W. 42nd St., New York, N. Y.

WANTED: Man as feed water analyst and assistant to superintendent of the University heating plant. State age, qualifications, and least salary in first letter to: University of Idaho, Heating Plant, Moscow, Idaho.

POWER PLANT ENGINEER with practical operating experience to operate small modern stoker fired steam plant and refrigeration equipment. Permanent post-war position for right party. In application state experience, education, references and salary. Location central Pennsylvania. P-559, Power, 330 W. 42nd St., New York, N. Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS—This advertising service of 33 years' recognized standing negotiates for high salaried supervisory, technical and executive positions. Procedure will be individualized to your personal requirements and will not conflict with Manpower Commission. Retaining fee protected by refund provision. Identity covered and present position protected. Send for details. R. W. Bixby, Inc. 270 Delward Bldg., Buffalo, N. Y.

POSITION WANTED

POSITION WANTED—20 years experience as operating and chief engineer in Textile and Paper Mills. Past 45 years of age. Married. PW-536, Power, 330 W. 42nd St., New York, N. Y.

POWER PLANT MECHANICAL ENGINEER —25 years in Consulting Practice and Plant Operation—M. I. T. graduate—Free to travel —American—Draft exempt. PW-547, Power, 330 W. 42nd St., New York, N. Y.

POSITION WANTED

MECHANICAL ENGINEER—Registered Professional Engineer, 18 years experience. Oil and pulverized coal firing, 150 and 600 pound pressures, reciprocating and turbine generators, power plant instruments and switchboards, machine tools, centrifugal and reciprocating refrigerating machines, air conditioning, machinery erection, and plant engineering. Married, Class 3A, 38. PW-560, Power, 330 W. 42nd St., New York, N. Y.

BUSINESS OPPORTUNITIY

MANUFACTURING RIGHTS WANTED—Independent manufacturer with complete engineering and research staff, production facilities, and international industrial sales organization wishes to develop new markets and products, particularly steam plant or allied process apparatus and in instrument and control fields. Write brief letter. BO-539, Power, 330 W. 42nd St., New York, N. Y.

MOTOR REWINDS?
ARE YOU PARTICULAR?
DO YOU HAVE A SPECIAL MOTOR?
We stock only the Best of Insulation
100% Factory Work
TRY US
Previous Experience with
General Electric Allis Chalmers
Westinghouse Navy Yard Work
C. V. HUNT
Est. 1916
Ridgefield, N. J. Morsemore 6-5091
Trucks #1—U.S. Highway and Erie Railroad

POWER PLANT CONTRACTORS
Complete Power Plants
Installed and Erected
Coal & Ash Conveyors
High Pressure Boilers
Power and Process Piping
AFGO ENGINEERING CORP.
147 Fulton St., New York City, N. Y.

W. L. SULLIVAN
* **MECHANICAL ENGINEERING** *
Also furnishing power plants, industrial, municipal and private, plants, designed, appraised or built, complete or parts, steam or other fuels, boilers, engines, pumps, machines and manufacturing plants also, new or used equipment.
P. O. BOX 236
Oklahoma City Oklahoma

Immediate Delivery
Two Taylor 10 Retort Type AA6 Stokers for 1000 HP boilers each. Will rebuild these into smaller stokers or sell for repair parts to suit your requirements.
CHAS. G. HARRISON COMPANY
12075 Greenfield Rd., Detroit, Mich.

FOR SALE
6 Ellison 14 Pointer, Airflow Type, Differential Draft Gauges. Range 0 to +2" differential, sealed +- to 8" static. Also some controlling mechanism for Windbox Venturi on Taylor Underfeed Stoker. These are used instruments, but in excellent condition. Immediate delivery.
PITTSBURGH PLATE GLASS COMPANY
COLUMBIA CHEMICAL DIVISION
BARBERTON, OHIO

ELECTRICAL POWER EQUIPMENT

Steam Turbo Generators

3 phase 60 cycle

3750 KVA GENERAL ELECTRIC 200 lbs. 2300/4000Y volts with surface condenser.

3125 KVA GENERAL ELECTRIC 225/400 lbs. 2400/4160 volts, with surface condenser

1875 KVA GENERAL ELECTRIC 150 lbs. 2300 volts with surface condenser

1250 KVA ALLIS CHALMERS 150/200 lbs. 2300 volts with jet condenser

937 KVA ALLIS CHALMERS 200 lbs. 2300 volts with surface condenser

625 KVA (3) GENERAL ELECTRIC bleeder, 150 lbs. 10 lbs. bleeder pressure, 240 volts with jet condensers

625 KVA (2) ALLIS-CHALMERS KERR non-condensing, 90 lbs. 10 lbs. back pressure, 480 volts

Steam Engine Generators

3 phase 60 cycle

675 KVA GENERAL ELECTRIC-AMES uniflow, 150 lbs. 5 lbs. back pressure, 240/480 volts

500 KVA ALLIS CHALMERS Corliss, 175 lbs. 25 lbs. back pressure, 240/480 volts

438 KVA GENERAL ELECTRIC-SKINNER uniflow, 150 lbs. 5 lbs. back pressure, 240/480/2300 volts

300 KVA GENERAL ELECTRIC-AMES twin uniflow, 175 lbs. 10 lbs. back pressure 240/480 volts

210 KVA GENERAL ELECTRIC-SKINNER uniflow, 150 lbs. 5 lbs. back pressure 240/480/2300 volts

SURFACE CONDENSER

1540 sq.ft. WORTHINGTON surface condenser with steam jet air pumps

Diesel Engine Generators

3 phase 60 cycle

333 KVA GENERAL ELECTRIC DE LAVERGNE 4 cylinder 2300 volts, 225 RPM

250 KVA (4) CROCKER WHEELER WORTHINGTON 6 cylinder 208/120 volts, 400 RPM

200 KVA FAIRBANKS-MORSE 4 cylinder 2400 volts, 257 RPM

170 KVA FAIRBANKS-MORSE 4 cylinder 2400 volts, 257 RPM

150 KVA WESTINGHOUSE WORTHINGTON 3 cylinder 480 volts 327 RPM

121 KVA FAIRBANKS-MORSE 2 cylinder 240 volts 300 RPM

57.7 KVA FAIRBANKS MORSE 1 cylinder 240 volts 300 RPM

49½ KVA FAIRBANKS MORSE 6 cylinder 2400 volts 1200 RPM

ROTARY CONVERTERS

3 phase 60 cycle

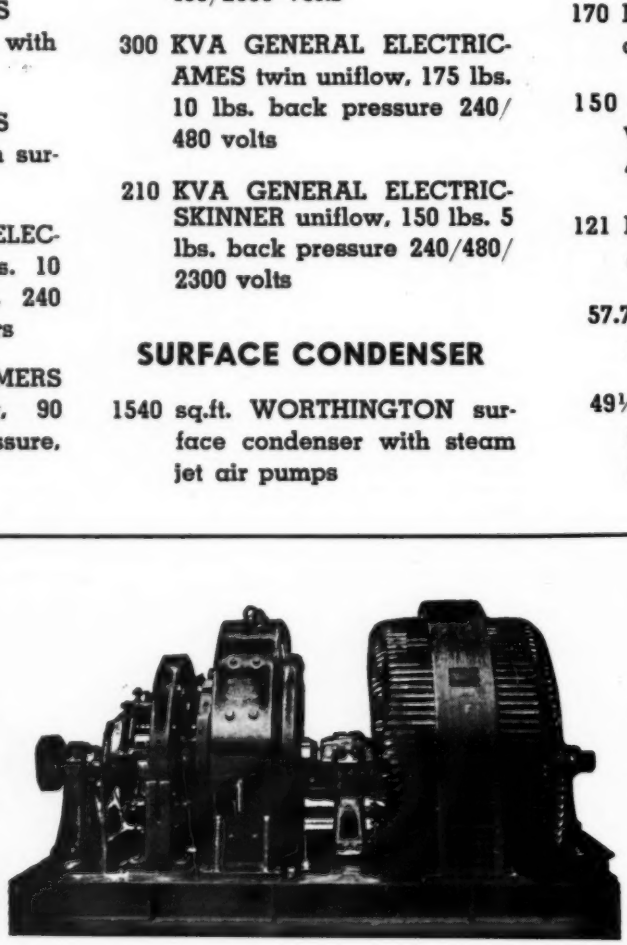
3500 KW (2) WESTINGHOUSE 225-285 volts D. C., 225 RPM, with 13200 volt transformers

1500 KW WESTINGHOUSE 225-285 volts D. C. 450 RPM, with 2300/4000-6900/12000 volt transformers

750 KW GENERAL ELECTRIC 600 volts D. C., 1200 RPM, with 2300/4000 volt transformers

750 KW WESTINGHOUSE 125/250 volts 3-wire D.C., 360 RPM, with 2300/13200 volt transformers

400 KW (2) GENERAL ELECTRIC 125/250 volts 3-wire D.C., 600 RPM with 2300 volt transformers



Actual Photograph

1000 KW GENERAL ELECTRIC MOTOR GENERATOR SET

1000 KW (1250 KW 2 hrs. 55 deg. C rises) GENERAL ELECTRIC direct current generator 125/250 volts 3-wire 720 RPM direct connected to 1400 HP 80% P.F. (1750 HP 2 hours 55 deg. C rise) GENERAL ELECTRIC synchronous motor 3 phase 60 cycle 13200/6600 volts 720 RPM. Equipped with D.C. breakers.

MOTOR GENERATOR SETS

3 phase 60 cycle

1000 KW GENERAL ELECTRIC synchronous 125/250 volts 3-wire D. C., 13200/6600 volts A. C., 720 RPM

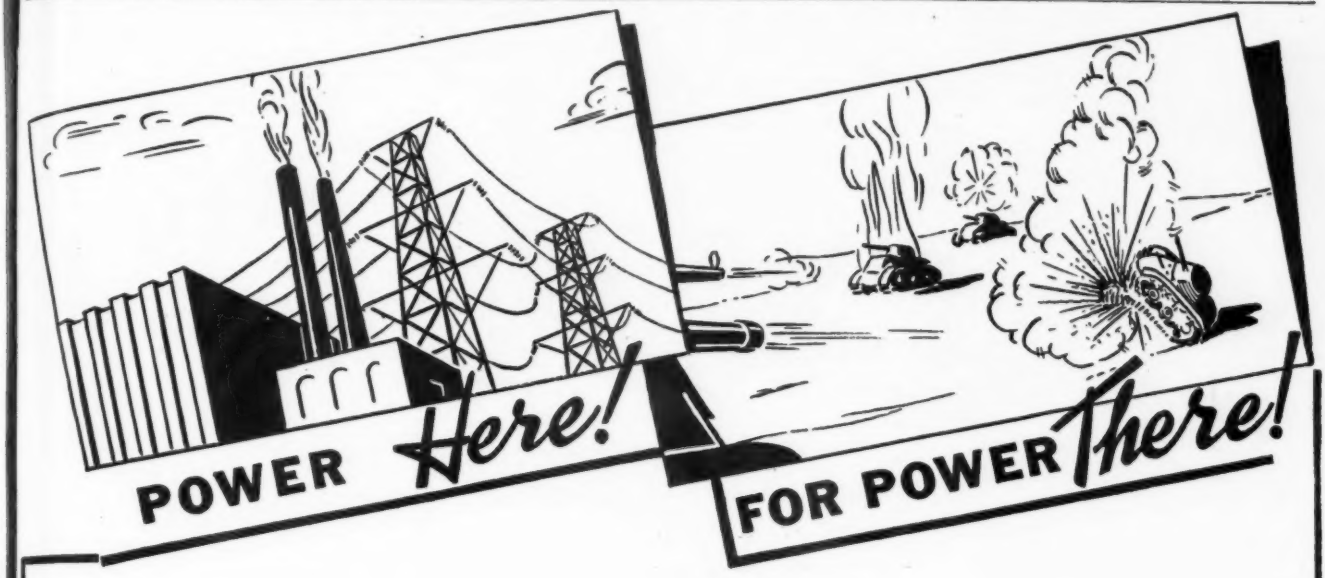
1000 KW GENERAL ELECTRIC 3-UNIT synchronous 125/250 volts D. C., 4000/2300 volts A. C., 720 RPM

800 KW WESTINGHOUSE 3-UNIT synchronous 250 volts D.C., 4000 volts A.C., 400 RPM

500 KW GENERAL ELECTRIC synchronous 700 volts D.C., 4150 volts A.C. 720 RPM

500 KW GENERAL ELECTRIC synchronous 250 volts D.C., 4000 volts A.C. 900 RPM

THE NATIONAL POWER MACHINERY CO.
1921 SCRANTON ROAD CLEVELAND, OHIO



MOTORS GENERATOR SETS

1—2000 ampere, 6 volt, Hanson-Van Winkle
1—1500 ampere, 6 volt, Hanson-Van Winkle
1—750 KW, 250 volt, Allis Chalmers synchronous
1—75 KW, 125 volt, Crocker-Wheeler synchronous
1—35 KW, 125 volt, Electric Machinery squirrel cage induction motor.
1—20 KW, 600 volt, General Electric squirrel cage induction motor.

ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—200 KVA, 3600 RPM, 240 volt, Allis Chal.
1—62½ KVA, 3600 RPM, 220 volts, Allis Chal.

MOTORS—3 PHASE 60 CYCLE

1—400 HP, 514 RPM, 440 volt, Westg., slip ring.
1—335 HP, 600 RPM, 2300 volt, G.E., syn.
1—300 HP, 720 RPM, 2200 volt, G.E., slip ring.
1—250 HP, 514 RPM, 4000 volt, G.E., syn.
1—250 HP, 600 RPM, 4000 volt, G.E., Sync.
1—200 HP, 600 RPM, 2200 volt, G.E., sl. rg.
1—200 HP, 450 RPM, 2200/4000 v., G.E., sl. rg.
1—150 HP, 1800 RPM, 440 volts, General Electric, squirrel cage
1—150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
1—150 HP, 720 RPM, 440 volt, G.E., sl. rg.
1—150 HP, 600 RPM, 440 volt, G.E., sl. rg.
1—150 HP, 400 RPM, 440 volt, G.E., sq. cg.
2—125 HP, 720 RPM, 440 volt, G.E., sl. rg.
1—100 HP, 900 RPM, 440, Westg., sq. cg.
1—100 HP, 900 RPM, 440 volt, G.E., sl. rg.
3—100 HP, 720 RPM, 440 volt, G.E., sl. rg.
1—100 HP, 720 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 600 RPM, 440 volt, G.E., sl. rg.
1—100 HP, 600 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 514 RPM, 440 volt, G.E., sq. cg.

INSTRUMENTS

25—Westinghouse type U Recording Ammeters with slit core, CT.

25—Westinghouse type U Recording Voltmeters.

MOTORS—3 PHASE 60 CYCLE (Con't)

2—100 HP, 450 RPM, 440 volt, G.E., sq. cg.
1—90 HP, 400 RPM, 550 volt, Cr. Whlr., sq. cg.
1—75 HP, 900 RPM, 4000 volt, Elec. Mach. syn.
1—75 HP, 900 RPM, 220 volt, Fairbanks Morse, slip ring.
1—75 HP, 900 RPM, 440 volt, G.E., sq. cg.
1—75 HP, 720 RPM, 440 volt, Westghse., slip ring.
1—75 HP, 720 RPM, 440 volt, G.E., sq. cg.
2—75 HP, 1200 RPM, 2200 volt, G.E., Vertical.
1—50 HP, 900 RPM, 440 volt, G.E., sl. rg.
1—50 HP, 900 RPM, 440 volt, G.E., sq. cg.

MOTORS—D.C. 230 VOLTS

2—450 HP, G.E., 400 RPM, Type MPL, Form 1-F.
1—250 HP, 760 RPM, Electro Dynamic.
2—150 HP, Westghse., 550 RPM, Type SK.
1—150 HP, 750 RPM, Electro Dynamic.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, G.E., 575 RPM.
1—100 HP, 625 RPM, G.E.
1—80 HP, Crocker-Wheeler, 600 RPM, Type CMC.
1—75 HP, G.E., 575 RPM, Type C, Sprague; with spare armature.
1—65 HP, 1000 RPM, G.E., Type RC.
8—50 HP, Crocker-Wheeler, 700 RPM, Type CM.
1—65 HP, G.E., 625 RPM, Type DLC-65, Form A.
1—50 HP, 750 RPM, Westghse., Type SK.
1—50 HP, 700 RPM, Crocker-Wheeler.
1—40 HP, G.E.-Sprague, 700 RPM, Type LC.
1—40 HP, 775 RPM, Westinghouse.
1—40 HP, 300 RPM, G.E.
1—30 HP, 750 RPM, G.E., type RC.
1—30 HP, G.E., 750 RPM, Type RC-14, Form A.
1—30 HP, G.E., 1100 RPM, Type RC-31B, Form A-21.
1—35 HP, G.E., 650 RPM, Type RC-15.
1—30 HP, G.E., 625 RPM, Type C.
1—25 HP, Westghse., 600 RPM, Type SK.
2—25 HP, G.E., 775 RPM, Type RC-13.
1—20 HP, G.E., 800 RPM, Type RC-12, Form A.
2—20 HP, Westghse., 1700 RPM, Type SK.
1—15 HP, G.E., 800 RPM, Type RC-11.

TRANSFORMERS

2—400 KVA, G.E., 4156-240/480 v., Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
3—250 KVA, G.E., 6600/2200/220/440
3—200 KVA, G.E., 2200/220/440
3—150 KVA, G.E., 33,000 2300/4000 Y.
3—100 KVA, Westinghouse, 11,430/250 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.
3—75 KVA, G.E., 13,500-750/440 volts.
1—75 KVA, G.E., 3 phase, 4156Y—120/208Y.
3—50 KVA, Wagner, 4150-220 volts.
2—50 KVA, Pbgh. 7500/15,000 volts-110/220 volts.
4—37½ KVA, 2200-220/110 v.
7—25 KVA, Westg., air cooled, 440/220-110 volts.
1—25 KVA, G.E., 220/110-220/110 volts.
2—15 KVA, G.E., 2300-115/230 volts.

MOTORS—VARIABLE SPEED 230 VOLTS

2—100 HP, 475/1375 RPM, Electro Dynamic.
1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—60 HP, 600/1200 RPM, General Electric.
1—35 HP, 500/1500 RPM, Westinghouse.
1—35 HP, 350/1050 RPM, Electro Dynamic.
1—30 HP, 225/900 RPM, Crocker Wheeler.
7—25 HP, Westinghouse, 650/2200 RPM, Type SK-110L.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—20 HP, 750/1500 RPM, General Electric.
1—15 HP, 300/1200 RPM, G.E.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker Wheeler.
1—5 HP, 400/1600 RPM, Diehl.
1—5 HP, 225/900 RPM, Electro Dynamic.

TURBO-GENERATORS

600 KW Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westghse., non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 v., cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 v., cond.

Hemphill FOR POWER

J. L. HEMPHILL & COMPANY

1602 53rd ST., NORTH BERGEN, N. J.

PHONE NEW YORK—LONGACRE 5-3227 NEW JERSEY—UNION 3-2600

KIEMLE OF TOLEDO, OHIO

MOTORS
GENERATORS
CONTROLS
TRANSFORMERS
MOTOR GENERATOR SETS
ETC.

BERGER OF ROCHESTER, N.Y.

Put all idle equipment to work. Send your list for prompt action.

TRANSFORMERS

1—600 KVA West.—Booster transformer (Auto Transformer Type) 204/208 volts 60 cy. 3 ph.
4—500 KVA Gen. Elec. Type H form KDD, 60 cy. Single Phase, Primary 6900 V or 11950 Y; secondary 2300V—with taps.
3—500 KVA, GE, type H, form VD525 19100-22000/40000Y to 2300, 1 phase 25 cycle.
6—150 KVA Gen. Elec. type H 22000/220/440 25 cy. single ph.
2—75 KVA West. type S.K. 1 ph. 25 cy. 60000 volts Prim—6900/2300 volts secondary.
1—200 KVA Allis Chal. 60 cy. 3 ph., 220/440.
1—300 KVA Gen. Elec. 60 cy. 3 ph., 220/440.

ALTERNATORS

240 KW, 8 PF Electric Machinery, 4600 volts, 60 cycle 3 phase, 450 rpm with direct connected exciter.
200 KVA Gen. Elec. Ft. Wayne 3 ph., 60, 220/440, 720 RPM, revolving field.
150 KVA Gen. Elec. Type ATB form D, 60, 3 ph., 220/440 600 RPM. revolving field, built-in exciter.
75 KVA Westinghouse 3 ph. 60 cy. 480 volts, 900 RPM, with separate belted exciter.

D. C. GENERATORS

150 KW Western Elec. 3 brg. 3 wire, 115/230 V, 600 RPM.
50 KW Milwaukee, Comp Wound 125 V, 600 RPM.

★400 H. P. SYNCHRONOUS MOTOR★

Complete A.C. Synchronous Motor

1—400 H.P. Wsghse Syn. motor, 3 ph, 60 cy 4000/2300 V, 400 RPM with built-in magnetic clutch. Complete panel mounted reduced voltage type Starting Control. Motor-Generator Set—factory built for excitation and clutch operation. 10 KW, 125 V, DC 1750 RPM, Type SK63, Wsghse, with direct conn. 15 HP, Type CS, 3 ph, 60 cy, 220/440 V.

300 KW Gen. Elect. Synchronous Converter, 6 Phase, type HCC form J, 25 cycle, 750 speed, 220/230 volts. With Transformers for 2300 Volts.

3 ph. 60 cy. A. C. MOTORS

H.P.	Make		Type		Speed	Volts
300	Gen. Elec.	Sl. Rg.	I Form M.		600	220/440
200	Wsghse.	Sl. Rg.	CW		600	220/440
200	Gen. Elec.	Sq. Cg.	I Form K		514	220/440
175	Ideal	Sl. Rg.	AVA		1750	2200
150	Gen. Elec.	Sq. Cg.	I	K	600	2300
150	Al Ch.	Sq. C.			600	440
150	Burke	Sq. Cg.	3 BRG. 2 ph		900	220/440
150	Elect. Mach.	Syn	—		1200	4150
125	Gen. Elec.	Sq. Cg.	I	K	720	220/440
125	Gen. Elec.	Sq. Cg.	KT547		1800	440

3 ph. 25 cy. MOTORS

H.P.	Make		Type		Speed	Volts
830	Elect. Mach.		Syn.		500	2300
	With Direct		Connected		Exciter	
200	Wsghse.	Sl. Rg.	CW		485	220/440
150	Gen. Elec.	Sl. Rg.	I Form M		500	2200
100	Wagner	Sl. Rg.	BR		750	220/440
100	Gen. Elec.	Sl. Rg.	I Form M		750	220/440
100	Gen. Elect.	Sq. C.	I	K	750	220/440
100	Wsghse.	Sq. C.	CS		500	220/440
75	Wsghse.	Sq. C.	CCL		500	220/440
75	Gen. Elect.	Sl. Rg.	I	M	750	220/440
75	Wagner	Sq. C.	BM		750	2200
75	Gen. Elec.	Var.	BTA		375/750	440
50	Burke	Syn.	AC133		750	220

230V D. C. MOTORS

H.P.	Make	Type	Speed
105	Gen. Elec.	CL/6 Shunt Wound	700
100	Sprague	C Interpole	600
100	Northwestern	K30 Comp. Inter.	1750
100	Wsghse.	SK143 Shunt Inter.	1750
85	Gen. Elec.	Vert. Comp. Wound	700
75	Crocker Wh.	CCM25JA	1700
50	West.	SK120	1700
40	Fair. Morse	Ball BRG. Vert. Comp.	1740
32	Sturdevant	C Form P. Shunt Wound	190

FREQUENCY CHANGERS

All sizes, voltages and cycles.

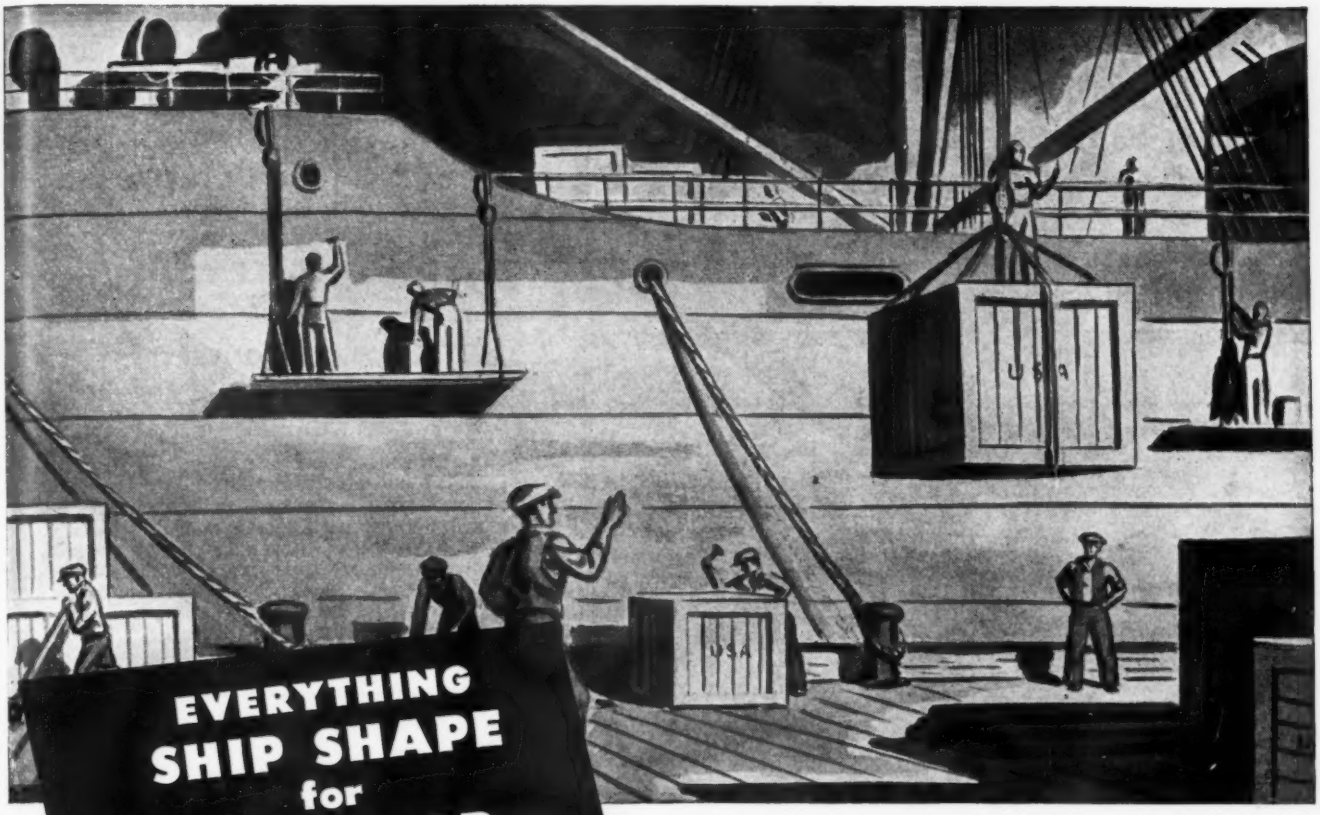
Only partial listing

OVER 10,000 ITEMS IN STOCK FOR IMMEDIATE DELIVERY FROM EITHER ROCHESTER, N. Y. OR TOLEDO, OHIO REBUILT AND SOLD WITH A STANDARD NEW GUARANTEE.

Write or wire your inquiries

BERGER BROTHERS ELECTRIC MOTORS, Inc.
395 STATE ST.
ROCHESTER NEW YORK

THE FRED W. KIEMLE CO.
33 N. SUPERIOR ST.
TOLEDO OHIO



EVERYTHING SHIP SHAPE for SHIP SHOP delivered on time

SHE was a vital convoy ship—due to sail in a week. But she still needed for her ship shop a drill, lathe and grinder. Best delivery on a drill was six weeks—four months for a lathe, and a grinder to the specifications required just could not be had. Could O'Brien do anything about it? Yes! O'Brien men worked and slept-in on shifts to rebuild a drill and lathe, converted a 220 volt D. C. buffer to a 115 volt grinder. Delivery to the dock was made in one week right on the button. This job is not unusual; O'Brien tackles and licks emergencies like it almost every day in the week. That's why so many machine tool and power plant equipment buyers say—"If O'Brien can't do it, it can't be done."

ELECTRIC MOTORS—3 Phase — A.C. — 60 Cycle

Quan.	H. P.	Make	Type	Volts	Speed
1	750	G. E.	K F	2200	1800
1	400	G. E.	F T	2200	3600
1	350	Cr. Wh.	Sl. Rg.	440	514
1	250	G. E.	I K	2200	1200
1	200	Cr. Wh.	Syn.	440	450
1	150	G. E.	IM	440	720
1	150	F. M.	Sq. Cg.	440	1800
1	150	Al. Ch.	Sq. Cg.	2200	900
1	100	West.	Syn.	440	900
1	100	G. E.	I K	2300	600
1	75	G. E.	KT 343	220	1200
1	75	G. E.	KT-Vert.	440	1800
1	75	G. E.	KT-Vert.	2200	1200
1	75	G. E.	I M	440	450
1	75	G. E.	I K	440	450
1	75	G. E.	ITC	440	900
1	50	G. E.	KT	220	900
4	40	G. E.	KT 323	220	1800
1	30	G. E.	KT 526	220	1200
1	30	Al. Ch.	Sq. Cg.	220	900
2	25	G. E.	KT 302	220	1800
1	25	G. E.	KT 322	2200	1200
2	25	G. E.	MT 332	220	900
1	25	Cent.	A S	220	3600
3	25	G. E.	KT 526	220	1200
2	20	West.	C S	220	1200
2	20	G. E.	KT 323	220	1200

DIRECT CURRENT

Quan.	H. P.	Make	Type	Volts	Speed
3	320	G. E.	MPC	230	1200
1	100	G. E.	DLC	230	800
1	65	West.	S	500	825
1	35	G. E.	DLC	230	850
1	30	G. E.	CD	500	600
1	25	G. E.	LC	230	570/1140
1	25	West.	SK	230	600
1	20	West	SK 90	230	1100
1	20	West	SK	230	900
1	15	West.	SK	230	1200
1	10	G. E.	RLC	230	600/1800

MOTOR GENERATOR SETS

1—750 K.W. G.E. 4 unit Set Including 3-250 K.W. G.E. —MPC—230 volt 1200 RPM Generator with 1200 HP Syn. Motor Drive. 3/60/2300/1200 RPM.
3—250 K.W. G.E.—MPC—240 volt 1200 RPM 3/60/2300.
1—200 K.W. Ridgeway 275 volt 3/60/4000/900 RPM.
1—100 K.W. West. 250 volt—150 H.P. Syn. 3/60/2300.
1—50 K.W. G.E. 125 volt 63 K.V.A. Syncronized Drive 3/60/220/1200.
1—50 K.W. G.E. 125 volt 75 H.P. Sq. Cg. 3/60/2300/720.
1—50 K.W. West. A.C. Gen. 3/60/220 with 75 H.P. SK 125 volt Motor 1200 RPM.
1—35 K.W. Fairbanks Morse 250 volt 60 H.P. Syn. 3/60/220/1200.

Everything from a Pulley to a Power House

THE O'BRIEN MACHINERY CO.

PHILADELPHIA'S LARGEST MACHINERY DEALERS AND EXPORTERS

113 NORTH THIRD STREET PHILADELPHIA PENNA.

BELL TELEPHONE: MARKET 4180 CABLE ADDRESS: OBRIEN-PHILA

BELYEA OFFERS

STOCK EQUIPMENT

shipment as fast as conditions allow

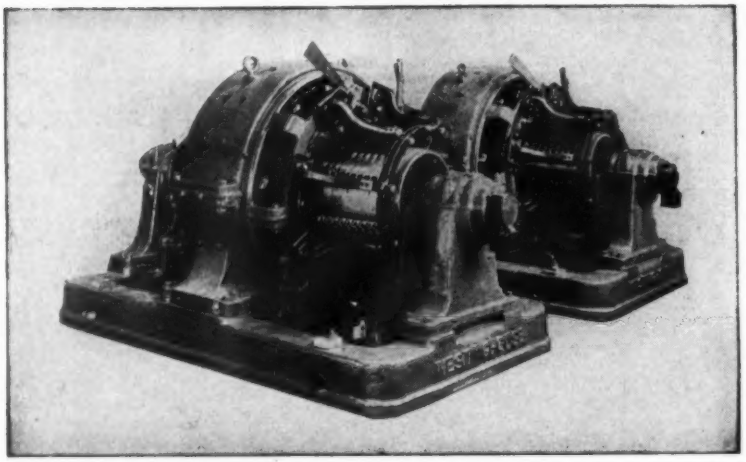


Photo above shows 2- 1000 KW. 600 volt, 60 cycle rotary converters which have been completely renovated. Once used for railway service, these units now help build ships.

ROTARY CONVERTERS

Primary 3 Phase 60 Cycle

1—1500 KW WHSE., 720 R.P.M., D.C. 600 V., A.C. 26,400/13,200 V.
1—1500 KW WHSE., 600 R.P.M., D.C. 600 V., A.C. 11500/10360 V.
1—1250 KW G.E., HCC, 720 R.P.M D.C 250 V., A.C. 2300 V.
1—1000 KW WHSE., 900 R.P.M., D.C. 600 V. A.C. 11000/23000 V.
2—750 KW WHSE., 1200 R.P.M., DC 600 V A.C. 5500/2300 V.
1—750 KW WHSE., 720 R.P.M., D.C. 250 V., A.C 6600/2200 V
1—500 KW WHSE., 900 R.P.M., D.C. 250 V., A.C. 6600/2200 V.
1—500 KW WHSE., 1200 R.P.M., D.C. 600 V., A.C. 2300 V.
3—375 KW WHSE., 1200 R.P.M., D.C. 250 V., A.C. 6600/2200 V.
3—300 KW G.E., HCC, 1200 R.P.M., D.C. 600 V., A.C. 2300 V.

ROTARY CONVERTERS

3 Phase, 25 Cycle Booster Type

2—1500 KW G.E., HCC, 500 RPM., D.C. 225/275 V., 6000 Amp., A.C. 13200/6600 V.
1—500 KW G.E., HCC, 750 R.P.M., D.C. 225/275 V., 2000 Amp., A.C. 6600 V.

MOTOR GENERATOR SETS

3 Phase 60 Cycle

1—1500 KW G.E., 600 V. D.C. to 2100 H.P. 6600 V.
1—500 KW, 3 unit consisting of 2—250 KW, G.E., 250 V., d.c., to 1—700 HP, 2300 V.
1—500 KW G.E., 600 V. D.C. to 700 H.P. 13200/6600 V.
1—500 KW G.E., 600 V. D.C. to 700 H.P. 2200 V.
1—500 KW G.E. 250 V. D.C. to 1000 KVA. 2300 V. Syn. Motor.
1—400 KW, G.E., 250/275 V., d.c. to 600 HP. 2300 V.
1—250 KW Cr. Wh. 230 V. D.C. to 450 KVA. 2300/4000 V. Syn. Motor.
1—150 KW G.E., 250 V. D.C. to 200 KVA, 440 V.
1—125 KW WHSE., 250 V. D.C. to 200 H.P. sq. cg., 440 V.
1—100 KW WHSE., 250 V. D.C. to 159 KVA. 2300 V.
1—100 KW WHSE., 230 V. D.C. to 175 H.P. sl. rg. 2200 V.
1—75 KW G.E., 125 V. D.C. to 120 H.P., sq. cg., 2300/4000 V.
2—50 KW G.E., CD, 125 V. D.C. to 75 H.P., sq. cg., 2300/4000 V.
1—40 KW WHSE., 230 V. D.C. to 45 KVA 2300 V.

TURBO GENERATOR SETS

500 KW Whse. 625 Kva. 440 V. 3 ph. 60 cy. 3600 RPM with Parsons 145/175 lb. cond. turbine complete with jet cond. and access.
1—500 KW G.E. 625 Kva 2300 V. 3 ph. 60 cy. with Curtis 4-stage 150 lb. cond. turbine with cond. and access.
1—75 KW Ridgeway 250 V. D.C. with Terry turbine 180 lb. pressure with 12 lb. bk. pres., 2700 RPM.

GEAR REDUCTION UNITS

1—2100 H.P. Whse. 1800/360 RPM.
1— 943 H.P. G.E. 5306/1200 RPM.
1— 750 H.P. Al. Ch. 3600/600 RPM.
1— 450 H.P. G.E. 3600/1200 RPM.

A. C. MOTORS

3 Phase—60 Cycle

SLIP RING

HP	Make	Type	Volts	Speed
2—1200	Cr. Wh.	801Q	2300	237
1— 800	Al Ch.	ANY	440	885
1— 800	Whse.	CW	440	357
1— 600	G.E.	IM	440	900
1— 450	Whse.	HW	2200	875
1— 400	Al Ch.	ANY	440	1200
1— 400	G.E.	MT	550/440	300
1— 400	Al Ch.	ANY	2300	505
1— 350	G.E.	MT-442	2300/4000	257
1— 300	G.E.	IM	440	720
1— 300	Whse.	CW	440	585
1— 250	G.E.	MT	4000/2300	257
2— 200	G.E.	IE-M	2200	1750
2— 200	Whse.	CW	2200	514
1— 200	G.E.	I-M	440	600
2— 175	G.E.	IE-M	2200	880
1— 150	G.E.	IM	2200	695
1— 150	G.E.	MT-564	440	600
1— 150	G.E.	IM-17B	2200	290

A. C. MOTORS

SQUIRREL CAGE

H.P.	Make	Type	Volts	Speed
1—500	G.E.	I-17B	2200	690
1—400	Whse.	CS-1104A	2200	585
1—300	Whse.	CS	550	580
1—300	G.E.	IK	440/2300	600
1—250	Al. Ch.		220/440	1150
1—200	Whse.	CS	2300	1200
1—200	G.E.	IK	2200	490
1—200	Whse.	CS	4600	900
1—150	Al. Ch.	AN	440	1765
1—100	Whse.	CS	550	1750

A. C. GENERATORS AND SYNC. MOTORS

3 Phase—60 Cycle

HP or KVA	Make	Type	Volts	Speed
1—1000	Whse.		2300	900
1— 625	Whse.		480	900
1— 500	G.E.	TS	440	360
1— 250	G.E.	ATB	2300	600
1— 250	G.E.	ATI	220	450
1— 225	G.E.	ATB	220	600
1— 159	Whse.		2400	900
1— 150	Whse.		4000	1800
1— 100	Whse.		2400	900
2— 100	Whse.		2300	1800

TRANSFORMERS

60 Cycle

KVA	Make	Ph.	Type	Voltages
3—1000	G.E.	1	HKDD	13200x2300
3—1000	Pitts.	1	OISC	2300/4600x57
4— 825	G.E.	1	HJ-DD	2300x445
3— 460	Whse.	1	S	2400x440
2— 333	Whse.	1	OISC	2300x460
2— 333	Pitts.	1	OISC	2400x220
3— 300	Pitts.	1	OISC	2300x115/2305
3— 300	G.E.	1	H	13200x2300/575
2— 200	G.E.	1	HILD	26400x115/460
3— 200	G.E.	1	H-KDD	13800x220/440
3— 150	Whse.	1	SK	2200x440/220
3— 150	Whse.	1	SKM	2400x120/240
6— 100	Whse.	1	SK	6900x460/230
3— 100	Whse.	1	OISC	13200x250

D. C. MOTORS

HP	Make	Type	Volts	Speed
1—1500	Whse.		550	330
1—1250	G.E.	MCF	250	650
2—1250	G.E.	MPC	500	130
1— 800	G.E.	MPC	550	600
2— 625	G.E.	MPC	250	130
2— 600	G.E.	MPC	550	600/800
1— 600	Whse.		230	150/275
1— 350	G.E.	MPC	230	450
1— 300	G.E.	MCF	230	400/1000
2— 300	G.E.	DMC	230	400/600
1— 300	Cr. Wh.	CMC 102H	230	1150
2— 300	Whse.		500	250/400
1— 300	G.E.	MPC	230	275/550
1— 300	G.E.	MPC	230	250/440
1— 250	Al. Ch.	Irt.	230	525
2— 200	Whse.		230	400/500
1— 175	Whse.	SK	250	150/525
6— 150	G.E.	RC-19	230	800/1000
1— 150	Whse.	SK	230	300/900
2— 125	G.E.	CO-1832	230	625
2— 120	Whse.	SK	230	720
1— 100	Al. Ch.		230	950/1150
3— 100	G.E.	LC	230	1200
1— 100	G.E.	MPC	230	225/450
1— 100	Whse.	SK	230	600
2— 100	G.E.	RC-19	230	575-720
1— 75	G.E.	C	230	500/1000
4— 60	Diehl	K-11	230	500/1000
2— 60	Cr. Wh.	CMC-65H	230	500/1000
4— 50	G.E.	RC-16	230	650/815
1— 50	Cr. Wh.	CMC-81H	230	300/900
1— 50	Cr. Wh.	CMC-80H	230	380/750
1— 50	G.E.	RC	230	400/1200

RE-NUBILT BELYEA MOTORS

SUCCESSFUL OPERATION GUARANTEED

BELYEA COMPANY INC.

Main Office & Shop: 43 HOWELL ST., JERSEY CITY, N. J.

Immediate Shipment for Quick Victory and Total Peace

under Highest War Production Board Allocation only

TURBOS—60 cycles

15000 KW capacity condensing, non-automatic bleeder (approved 275# 550° t.t.) volume extraction at either 100 or 65# q.b.p. Elspecs 60/3/standard voltage. Complete going unit including surface condenser, all auxiliaries and piping.

•

3—5000 KW 80% nominal, 7200 KVA range, 225# I.S.P. Elspecs 60/3/2300/3600. High percentage original full strength, otherwise necessary blading in stock.

1—3150 Kva Curtis Multi Stage condensing 60/3/2300 or 4100 V. 9000 ft. Condenser. Complete going layout, excellent condition just approved, F.O.B. release after long high line standby service.

3—2000 KW 80% nominal, 2500 KW approved range 60/3/1-440, 2-2300, condensing design and approved for non-condensing.

•

Several 300, 500, 750, 1000, 1200 and 1500 KW condensing standard pressure, also mixed pressure design.

•

TURBOS—25 cycles

50,000 KW total aggregate capacity, unit sizes of 3,000, 6,000 to 20,000 KW surface condenser equipped complete going units. High percentage full strength.

SURFACE CONDENSERS

8250, 11000, 12000, 15000 and 20000 sq. ft. surface condenser units complete. Log service on pure clear water. Condition sound.

WATER TUBE BOILERS

2—350# ASME 80,000/120,000# t.s.g. cross drum units, underfeed stoker equipped.

WATER TUBE BOILERS (Con't)

2—350# ASME 80,000/120,000# t.s.g. bent tube design, powdered fuel fired; one complete with boiler house stack, all auxiliaries, completely rebuilt and never operated.

•

3—700 HP 160,000# t.s.g. straight tube box steel header 200# ASME, without firing equipment.

•

8—400 HP 200# ASME bent tube design, superheaters, soot blowers, fans, heaters, coal and ash handling paraphernalia, etc. Also complete steel building.

•

12—200/500 HP straight and bent tube 200# units.

STOKERS

50 underfeed ram type stokers now operating in 11 retort per boiler layout under 700,000# t.s.g. units. Clinker grinders, fans and other auxiliaries available. All now under dismantling schedule.

•

1—120,000# t.s.g. powdered fuel pulverizer, burners, fans, ducts, etc. Brand new.

LARGE POWER TRANSFORMERS

50,000 KVA O.I.W.C. transformers, 150000/135000 delta—41,600/36,400; or 72,000/63,000 star.

•

9000 KVA transformers, as above.

•

15000 KVA O.I.W.C. 60,000/54,000—18,000/9000.

•

12000 KVA O.I.W.C. transformers, 16,000 through 12,000, 500 and 250 KVA unit sizes, 75,000/43,000—2300 and other standard voltage ratios.

Complete data available on request.

"SQUARE COOPERATION IN HEAVY POWER THRU THREE WARS"

"May we confirm the record with you, face to face?" . . .P.S.

SEARCHLIGHT SECTION

SPECIALS

3—1600 Amp. Gen. Elec. 20 to 60 Volt D.C. Generators, type MPC 1150 RPM

2—300 HP Gen. Elec. 230 V. D.C. Motors type MPC.

4—1600/800 amp. Westinghouse 30/60 Volt D.C. Generators 600 RPM

230 Volt D. C. Motors

PARTIAL LISTING

H.P.	Make	Type	Speed
300	G.E.	MPC	1150
150	West.		600
85	G.E.	TRC37	880
60	Roth		600
50	Cr. Wh.	CMC	700(2)
50	G.E.	CL50	560
50	G.E.	RC15	850
46	Diehl	K10	850/1020
40	G.E.	CL6	975
35	West.	Sk120	1150
35	G.E.	RLC204	440/800
30	West.	S6	1025
30	West.	Sk120	975
30	West.	SA	500/1500(3)
26	Diehl	K8	850/1020
25	Eck.		1150
25	Rel.	92T	1150
25	West.	Sk11OL	1100
25	G.E.	RC31	1150
25	All. Ch.	E100	1150
25	G.E.	CD93	1150
25	G.E.	DLC202	700
25	G.E.	CD113	575
25	Rel.	310T	300/1200
20	West.	Sk83	1750(2)
20	Cr. Wh.	CM	1750
20	G.E.	CD	1750
20	G.E.	CD83	1200/1600
20	R. & M.		1160
20	G.E.	RC30	1150(2)
20	G.E.	CD85	1150
20	West.	SK103	1150
20	G.E.	RC31	1150
20	West.	Sk93	1150
20	G.E.	RC11	1150
20	West.	S6	975
20	G.E.	RC12	800(2)
20	West.	Sk11OL	750
20	A.-C.	Ser.	625
20	Rel.	T	400/1600
19	West.	S	1300(2)
17½	Sprague	D	1750
15	G.E.	RC2980	1700
15	Star		1450
15	West.	SK 70L	1250
15	G.E.	CVC	1250
15	Eck.		1100
15	G.E.	CD83	1150(3)
15	G.E.	RC29	1150(3)
15	West.	SK	1100
15	Cr. Wh.	CMC	900/1800
15	West.	S6	875/1600
15	West.	Sk93	850
15	G.E.	CQC	400/1200
13	Nat.	C8	1100
13	G.E.	RLC	800/1500

H.P.	Make	Type	Speed
13	G.E.	CVC112	1100
13	Diehl		200/247
10	Rel.	34T	1750
10	Cr. Wh.	CM	1450
10	G.E.	RC29	850(2)
10	West.	Sk70	850(2)
10	West.	S	835
10	G.E.	RC29A	825
10	G.E.	CVC	700(2)
10	Diehl		1750
10	All. Ch.	E100	600/1800
10	West.	SK	600/1200
10	G.E.	RF	400/1600
10	West.	SA	400/1200(2)
9	L.-Allis.	NA434	1750
9	G.E.	RF10A	450/1800
8½	Diehl		900/1080
8½	West.	SK	850
8	Cr. W.	SM	910
8	G.E.	RLC	500/1500
15	G.E.	CO	625
7½	Sturt.	TF	3600
7½	Cr. W.	CM	1800
7½	Peerless		1700(2)
7½	Line.	5S	1750
7½	West.	SK43	1450
7½	West.	SK	1150(2)
7½	G.E.	CD73	1150
7½	Cr. W.		900
7½	West.	SK50	975
7½	Niles	Crane	
7½	E.-D.	3S	550/1650
7½	Watson	BW	525/1150
7½	G.E.	RF10	450/1800
7½	West.	SA6	400/1600
7½	G.E.	RLC115	400/1600
7½	All. Ch.		350/1050
7½	G.E.	RLC200	300/1200
7½	G.E.	RLC115	400/1600
6	Roth		1150
6	G.E.	RC29A	850
6	G.E.	RF9	450/1800(2)
5½	West.	SK43	860
7½	G.E.	CO5	1525
5½	G.E.	CVC114	900(2)
7½	G.E.	CQC10	400/1600
5½	West.	SK60	500/1500(2)
5	G.E.	CD	1750
5	R. & M.		1750
5	West.	SK	1700(2)
5	Rel.	HZ	1750
5	G.E.	RC	1700
5	G.E.	CQ	1650
5	G.E.	CVC118	1650
5	G.E.	RC7	1150
5	G.E.	CVC85	1150

H.P.	Make	Type	Speed
5	West.	Sk30	1100(2)
5	All. Ch.	E70	1150
5	G.E.	CVC113	1130(4)
5	G.E.	CQ	1100
5	G.E.	RC27A	1150(2)
5	Cr. W.	CM	960(3)
5	West.	S3	870/1750
5	Sprague	RF5	950
5	Cr. W.	CCM	950(2)
5	West.	SK40	850(2)
5	G.E.	CD73	850
5	Cont.	D49	600/1800
5	Cr. W.	CM	500
5	Star	SP10	600/1200
5	El. Dyn.	3S	550/1650
5	G.E.	CR	500/1500(3)
5	G.E.	RLC114	450/1800
5	G.E.	RF9	450/1800
5	G.E.	CVC114	600
5	G.E.	RF9	450/1350
5	West.	SA5	400/1200
5	El. Dyn.		275/1100
5	G.E.	LC	850/1050
4	Diehl	C404	1150
4	Cr. Wh.	CM	780
4	Northern	Crane	800
3½	L. Allis	Vert.	1750
3½	Cr. Wh.	Ser.	1150
3½	West.	S2	975
3½	West.	Sk90	850/1600
3½	West.	Sk30	850(3)
3½	Diehl	K	550
3½	El. Dyn.	3S	485
3	Star		1750
3	R. & M.	S125	1750
3	West.	CD926	1750
3	G.E.	RC25	1800(4)
3	G.E.	CO	1650
3	Sprague	Lundell	1350
3	G.E.	CD	1200(2)
3	G.E.	RC26A	1150(2)
3	Mar. Card		1200
3	West.	SK20	1150(4)
3	West.	W254	1150
3	Star	SBF	1200
3	Master		1200
3	G.E.	CVC112	1100
3	Cr. W.	CM & Vert.	1050
3	Line.		900
3	Amer. Ldry.		900
3	Diehl	C404	850
3	G.E.	CV65	850
3	G.E.	RF7	650/1300
3	Sprague		650
3	Roth		500/2200
3	G.E.	RL55	500/1500

H.P.	Make	Type	Speed
3	G.E.	RLC111	500/1500
2½	West.	SK20	900/1800
2½	Garwood		600
2½	Diehl	LS	700/1400
2½	G.E.	RC4	1000
2½	West.	SK30	480/1800
2	Watson		1800(3)
2	West.	CD	1725(2)
2	Burke	AB2	1700
2	Cr. W.	CM	1600
2	West.	CD	1180
2	Watson	AW	1150
2	Cr. W.		1150
2	Sturt.	D	1150
2	R. & M.		1150
2	Star	SB2	900
2	West.	SK20	850(8)
2	Diehl	LS	700/2100
2	Sprague	RT3	700/1400
2	Rochester		600
2	Rel.	D	400/1200
1½	Cr. W.	CM	460
1½	El. Dyn.	1S	650/1300
1½	G.E.	RA	1700(2)
1½	G.E.	BD	1750(2)
1½	Watson	AW	1750
1½	West.	CD	1725
1½	Eck.		1300
1½	Roth		1200
1½	Cr. W.	CM	1250
1½	West.	SK8C	1140
1½	Cr. W.	CM	950
1½	West.	Sk10	900(3)
1½	Sturt.	D	850
1½	Diehl	G304	800
1½	West.	SK43	260/1000
1½	Cr. W.	CM	500(3)
1½	Cr. W.	CM	1175
1	Eck.		2400
1	Watson		1800
1	West.	CD	1725
1	G.E.	RC22	1700
1	Cr. W.	CM	1625
1	Eck.		1450
1	West.	CD	1450
1	N. W.	Crane	1300(6)
1	G.E.	CQ	1275
1	G.E.	BD224	1150
1	Cr. W.	CCM	1200(2)
1	G E.	RC4	1150
1	West.	CD	1140
1	Watson		900
1	G E.	CD55	850(2)
1	G.E.	RL54	575/1725
1	El. Dyn.		600
1	Diehl		470
1	Rel.	RC6	450
1	Rel.	T	54/109

300 additional 230 V. DC Motors from 1/6 HP to 1 HP various speeds.

ONE YEAR GUARANTEE

New York City's Largest Stock Electrical Equipment

L. J. LAND & CO.

146 GRAND ST. NEW YORK, N. Y.

READING, PA.
10TH AND EXETER STS.

YORK, PENNA.
227 NORTH GEORGE ST.

REBUILT POWER EQUIPMENT

READY TO SHIP!

ROTARY CONVERTERS

1—200 kw. G. E. 275 v. 900 rpm., 6 ph. 60 cy. complete with overspeed device and transformers.

1—500 kw. G. E. type HC-8 600 volt, 900 rpm., 6 ph., 60 cy. pedestal bearing with overspeed device complete with transformers.

MOTOR GENERATOR SETS

150 KW Ridgway 250 v. D.C. 900 rpm. dir. con. 2300/3/60 syn. motor, complete.

ENGINE GENERATOR SETS

225 kw. Elec. Machy. 2200 or 220 v. 3 ph. 6 cy. dir. con. Ideal Steam.

1—225 kw. Elec. Machy. 2200/220 or 440 v. 3 ph. 60 cy., 200 rpm, dir. con. Ideal Engine 4 valve non-releasing.

100 HP. LIGERWOOD HOIST

Double drum Speedwell 2500 lb. pull at 450' per min. direct driven by 100 hp. A.C. or D.C. Motor.

A.C. GENERATORS

219 kva. G.E. 2300/3/60 200 rpm. 80% P.F. (Can be reconnected 440 or 220 v.)

1—250 KW, 480 V., 3/60, Allis-Chalmers, 150 rpm.

D.C. GENERATORS

1—750 KW, 250 v. D.C., 115 rpm., West.

A.C. MOTORS—3 ph. 60 cy.

Qu	H.P.	Make	Volts	Speed	Type
18	1/3	G.E.	220	900	K
33	1/2	G.E.	220	1140	K
19	1½	Ilg. (Totally enclosed)	220	490	ball bearing
18	2	Ilg.	220	600	ball bearing
5	5	G.E.	220	900	KT-751
6	10	American (Enclosed — ball bearing)	440	1200	PK
1	10	Allis Chal.	220	1200	
1	10	G. E.	220	1200	K-326
1	10	G. E.	220	900	KT-502
1	10	Allis Chal.	440	575	
1	10	American (Enclosed — ball bearing)	440	570	PK
3	10	G E.	440	570	KT-322
11	10	G E.	440	495	KT-332
9	15	Allis Chal.	440	1500	AN
1	15	G. E.	440	1800	I-10
1	15	G. E.	220	1200	KT-954
1	15	Burke	220	1200	EM1.2
1	15	G. E. (High torque — low starting current — across the line start)	440	1200	FTR-502
1	15	Triumph	220	1150	
1	15	G. E.	440	900	I-K
1	15	G. E.	440	900	KT-322
2	15/30	West (Two speed induction Motor)	220	550/1100	MS
1	15	Allis Chal.	440	860	ball bearing
1	15	G E.	440	865	
1	15	West.	440	860	CS
2	15	Triumph	440	850	ball bearing
3	15	G. E.	440	690	KT
3	15	G. E.	440	575	KT-326
8	15	G. E.	220	570	KT-332
2	15	West.	220	550	MS
1	15	West.	440	450	CS
1	15/45	West.	440	450/850	CS
9	20	Allis Chal.	440	1800	AN
1	20	West.	220	1750	
1	20	Reliance	440	1200	
10	20	American (Enclosed — ball bearing)	440	1200	PK
1	20	G. E.	440	1200	KT
1	20	G. E.	440	575	
1	20	G. E.	220	900	KT-522
1	20	Triumph (High torque)	220	900	TR10-S
1	20	G. E.	220	900	
1	20	Allis Chal.	440	720	
9	20	G. E.	440	690	KT-322
1	20	G. E.	220	690	KT-332
1	20	West.	440	580	
1	25	Crocker Wh.	220	1150	118-Q
2	25	G. E.	220	900	KT-326
1	25	Crocker Wh.	220	900	
1	25	G. E.	220	900	KT-332
2	25	West.	220	720	CS
1	30	Allis Chal.	440	1800	
1	30	G. E.	440	1200	KT-332
2	30	West.	220	1100	MS
1	30	Triumph	220	900	B-128
1	30	Allis Chal.	220	900	
1	30	Allis Chal.	220	900	NR
1	30	Triumph	220	525	TR-138
1	35	G. E.	440	1200	I
1	35	Lincoln	220	720	
1	35	G. E.	440	600	KT
2	35	West.	220	514	CS
1	30/36	G. E.	220	3600	KT-205y
2	35	G. E.	550	900	I-8
1	35	Crocker Wh.	220	570	122Q
1	40	Allis Chal.	220	900	
1	40	Century (Automatic Start)	440	900	AS-40
1	40	G. E.	220	720	KT-346

A.C. MOTORS—3 ph. 60 cy.—cont

No.	H.P.	Make	Volts	RPM.	Type
1	40	Amer. Elec. (Vertical ball bearing)	440	685	
2	40	Am. Elec. (Enclosed ball bearing)	440	685	PK
1	40	West.	220	600	CS
1	45	West.	440	850	CS
1	50	U. S. Elec. (Vertical — ball bearing — automatic start)	440	3600	STUS
7	50	Allis Chal.	440	1800	AN
2	50	West.	440	1800	C
1	50	G. E.	440	1800	KT
1	50	G. E.	220	1200	KT-343
1	50	Crocker Wh.	220	1160	
1	50	West.	440	1120	C
1	50	G. E.	440	900	KT-342
1	50	G. E.	440	900	I-8
2	50	West. Elec.	440	870	
3	50	Wagner	440	850	
1	50	West.	440	850	CCL
1	50	West.	440	650	CCL
2	50	West.	220	600	CS-752C
1	50/100	West.	440	346/700	CS
1	54	Allis Chal.	440	900	
6	60	Allis Chal.	440	1800	AN
1	60	G. E.	440	1800	KT
1	60	West.	440	1800	C
1	60	G. E.	220	720	I-8
1	60	Crocker Wh.	220	670	122Q
1	60	Triumph	220	430	
1	65	West.	440	1800	M
6	65	Allis Chal.	440	1800	AN
3	65	G. E.	440	1800	KT-347
2	75	Louis Allis Adjusto speed clutch motors — normal torque — low starting current, ball bearing, nema frames)	440	450/1725	DV-505y
1	75	G. E. (Ball bearing, drip proof — normal torque low starting current)	440	1180	FT-542
1	75	G. E.	220	900	I-8
1	75	G. E.	440/550	720	I-10
1	75	West.	220	600	CS
1	75	Crocker Wh.	220	514	124Q
3	100	G. E.	440	1800	KT-347
1	100	G. E. (Ball bearing, Drip Proof — Norma Torque — Low Starting Current)	440	1800	FT-542S
1	100	West.	220	1750	
1	100	G. E.	220	1200	I-8
1	100	Allis Chal.	440	900	
1	100	G. E.	440	720	I-K-14
1	100	Allis Chal.	220	600	
1	100	Crocker Wh.	220	575	124QB
1	100	G. E.	440	400	I K
1	100	G E.	440	200	syn
1	125	Wagner	440	1800	
1	125	G. E.	440	1800	I
1	125	Allis Chal.	440	1800	AN
1	125	Crocker Wh.	220	720	124QB
1	125	Allis Chal.	440	695	
2	125	G. E.	550	514	I-K
1	125	G E.	440	450	I-K
1	125	G. E.	220	400	I-K
1	125	G. E.	550	400	I-K
1	150	Allis Chal.	2200	1800	AR
1	150	Wagner	440	1800	
1	150	G. E.	440	1800	I-4
1	150	Allis Chal.	440	1800	AN
2	150	G E.	440	900	I-K
2	150	G. E.	440	600	I-K
1	150	G. E.	550	575	I-K
2	150	G. E.	550	514	I-K
1	150	G. E.	440	514	I-K
1	150	G. E.	220	450	I-K
1	150	G. E.	550	450	I-K
1	150	G. E.	2200	220/400	450/243
1	150	West.	2200	327	syn
2	150	G. E.	440	200	syn
1	200	G. E.	2200	1800	KT
1	200	G. E.	2200	1200	I-K
1	200	West.	2200	900	CS-967A
2	200	G. E.	550	720	I-K
1	200	West.	220	580	CS
2	200	G. E.	220	600	I-K
2	200	G. E.	550	600	I-K
1	200	G. E.	550	514	I-K
1	200	G. E.	220	514	I-K
4	200	Allis Chal.	2300	347	AN
1	225	G. E.	2200	200	syn
1	250	G. E.	550	720	I-K
4	250	Allis Chal.	2300	435	AN
1	260	West.	2200	450	Syn.
4	400	West.	2200/220/440	500	CS
1	1000	G. E.	2300	509	K

SLIPRING MOTORS—3 ph. 60 cy.

No.	HP	Make	Type	Volts	RPM
1	1500	Westg.	CW	2200	435
1	700	G. E.	MT-432	2200	393
1	400	Westg.	CW	440/220	1170
1	300	Westg.	CW-1106	2200	580
1	300	W. El.	I-12	440/220	600
1	250	Westg.	CW	2200	345
2	250	G. E.	I	550	600
1	100	G. E.	I	220	450
1	100	Westg.	CI	220/440	1750
1	75	Cr. Wh.		220/440	875
1	60	Triumph	C-16	220/440	430
1	60	Westg.	HF	2200	690
1	53	G. E.	I	220/550	1165

SLIPRING MOTORS—3 ph. 60 cy.—con.

No.	HP	Make	Type	Volts	RPM
1	52	G. E.	ITC5012	220/440	900
1	50	G. E.	MT556	440/220	430
1	50	Westg.	HF	440/220	860
1	50	Al. Ch.		440/220	900
2	50	Westg.	HF	220/440	1120
2	50	Westg.	CW636A	440/220	1150
2	40	G. E.	MT	220/440	1155
1	40	G. E.	I	440/220	1200
1	25	Westg.	MW	220/440	680
1	25	G E.	I	440/220	670
1	25	Westg.	CI	220/440	900

D.C. MOTOR

1—800 HP, West. 650 V. D.C., 370 rpm.

TRANSFORMERS—1ph. 60 cy.

3—1500 Kva. Pittsburgh Transformers, 22,000 volt Primary, 6900/6600/2200 volt secondary.

No.	Kva.	Pri.	Sec.	Make	Ph.
1	250	2300	460	G. E.	
3	150	22000	6900	Pgh.	
1	150	2200	230/460	G. E.	3 ph.
1	100	2200	110/220	G. E.	
3	100	6600	550/440/220	Pgh.	
2	75	2200	220	Burke	3 ph.
2	50	2300	220/440	G. E.	
3	50	11430/6600	550	Al. Ch.	
3	50	6600	575	G. E.	
1	37½	2300	220/440	Wagner	
3	37	4400	185	West.	(Rotary)
1	30	2200	110/220	G. E.	
2	30	440	220/110	West.	
25	25	2200	122/244	G. E.	
3	15	2200	122/244	G. E.	
35	10	2200	122/244	G. E.	
40	10	2200	122/244	West.	
100	7½	2200	122/244	G. E.	
50	7½	2200	122/244	West.	
50	5	2200	122/244	G. E.	
75	5	2200	122/244	West.	

SERIES MOTORS

Qu.	HP	Make	Type	RPM	Volts
1	175	G. E.	MD-109½	475	230
1	80	Westg.	K-10	435	500
1	15	Cr Wh.	SM-58	270	230
1	10	Westg.		1100	500
1	10	G. E.	CQ	650	230
3	10	G. E.	CO-2504	700	110
3	7½	Cr Wh.	AW	800	230
1	5	Imp.		540	250
3	3½	Westg.		600	250
6	2	Reliance	HZ	850	230
2	1	Westg.	CD-923	900	230

VARIABLE SPEED MOTORS—230 V. D.C.

No.	Hp.	Make	Type	RPM
1	200	West.	SK-	400/800
1	100	G. E.	re-39	600/720
1	35	West.	sk-140	675-1350
1	30	West.	sk-123	850/1700
1	30	G. E.	rio-	450/900
1	20	West.	sk-120	700/1400
4	20	West.	sk- 10L	750/1500
2	10	G. E.	le	625/1250
1	5	G. E.	CD-85	450/1800
2	3	Jants Lieet	BI	650/1950
3	2½	G. E.		500/1000
1	2	West.	SK-63	300/1800
1	2	West.	SK-23	700/2100
1	½	Northern		700/2100

25-30 cy. MOTORS 220/440 V. A.C.

Qu	HP	Make	Type	RPM
1	75	G. E.	I-4	900
1	75	G. E.	KT-357	900
1	75	Allis-Chalmers	AN	900
3	50	G. E.	KT-547	900
3	40	G. E.	KT-347	900
6	40	Allis-Chalmers	AN	900
1	35	Western Elec.	SL13B	500
1	35	West.	M	900
1	30	West.	C	720
1	30	G. E.	KT	900
7	30	Allis-Chalmers	AN	900
2	25	West.	MS	715
9	10	Allis-Chalmers	AN	900
1	10	G. E.	1-4-10	900
1	5	G. E.	MT	695
1	3	West.	S	1450
1	3	Wester Elec.	CL7 BA	1500
2	2	G E.	K	1410
1	2	West.	CS	710
1	2	Hawthorne	CL7 AA	750
1	2	West.	CS	695
1	1	West.	CSA	750
1	½	Century		1460

DIESEL ENGINE GENERATOR SET

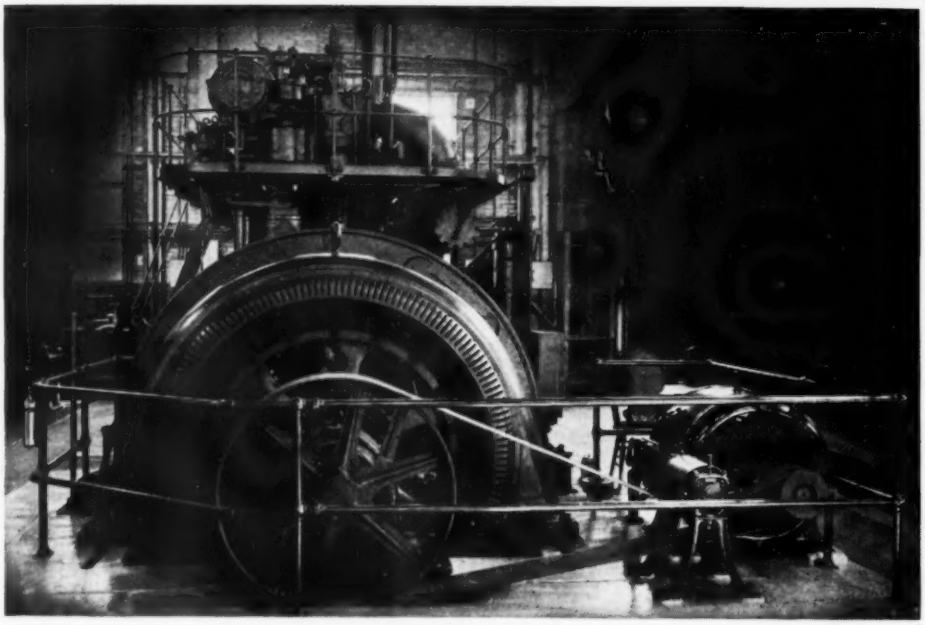
217 KVA G.E. 2300/3/60 dir. con. 260 HP Buckeye 2 cyl. 200 rpm. semi-diesel engine, complete.

WRITE, WIRE OR PHONE YOUR ELECTRICAL REQUIREMENTS

DUQUESNE ELECTRIC & MFG. CO.

PITTSBURGH, PA.

450 KVA DIESEL ENGINE-GENERATOR UNIT



ACTUAL PHOTOGRAPH

AVAILABLE IMMEDIATE DELIVERY

450 KVA General Electric; 2 or 3 phase, 60 cycle, 2300/550/440 volts, 200 RPM alternating current generator direct connected to Busch-Sulzer vertical full Diesel engine complete with auxiliaries. A#1 operative condition—still on original foundation for operating test.

TURBINE-GENERATOR UNITS

3 Phase, 60 Cycle

6250 KVA Westinghouse condensing 175-200 lb. pressure, 2300 volts, complete with surface condenser and auxiliaries.

3125 KVA—2500 KW 80% P.F. General Electric, 2300 volts, 3600 RPM, 180-200 lbs. pressure, 500 degree total temperaature, equipped with surface condenser, condensing auxiliaries, panels and instruments. A complete installation.

1875 KVA General Electric condensing 175-200 lb. pressure, 500° T.T., 6600 volts, 3600 RPM complete with either surface or jet condenser.

1250 KVA General Electric condensing 200 lb. pressure, 500° T.T., 2300 volts, 3600 RPM complete with surface condenser.

937 KVA General Electric condensing 200 lb. pressure, 100° SH, 2300 volts, 3600 RPM complete with condenser, exciter, switchboard and instruments.

937 KVA Allis condensing 150 to 200 lb. pressure, 475° T.T., 2300 volts, 3600 RPM, complete with direct connected exciter, surface condenser and auxiliaries.

625 KVA General Electric condensing 200 lb. pressure, 2300 volts, 3600 RPM, complete with condenser and auxiliaries.

375 KVA General Electric condensing 150-200 lb. pressure, 100° SH, 2300 volts, 3600 RPM complete with surface condenser and auxiliaries.

TURBINE-GENERATOR UNITS

3 phase, 60 cycle—(Cont.)

375 KVA (2) General Electric non-condensing, 150-175 lb. pressure, 5 lb. back pressure, 2300 volts, 3600 RPM each complete with direct connected exciter and rheostats.

ENGINE-GENERATOR UNITS

Direct Current

1000 KW Westinghouse, 250 volts, 514 RPM generator direct connected through reduction gear to Westinghouse condensing turbine, 150-200 lb. pressure, equipped surface condenser.

600 KW Crocker-Wheeler 250 volts, 300 RPM generator direct connected to a 14" x 18", 4 cylinder Ames vertical Unaflow non-condensing engine, 150-175 lb. pressure, 5 lb. gauge back pressure, complete switchboard and instruments.

400 KW General Electric, 125 volts, 165 RPM generator direct connected 26" x 28" Elliott Ridgway Unaflow non-condensing engine, 150 lb. pressure, 5 lb. back pressure.

300 KW Westinghouse 250 volts, 175 RPM generator direct connected 24" x 26" Skinner Unaflow non-condensing engine, 110-150 lb. pressure, 5 lb. back pressure.

ENGINE-GENERATOR UNITS

3 phase, 60 cycle—Alternating Current

438 KVA G.E. 480 volts, 200 RPM generator direct connected 23" x 24" Skinner Unaflow non-condensing engine 125-160 lb., 5 lb. gauge back pressure. Complete installation.

312 KVA Elliott 4000/2300/550 or 240 volts, 180 RPM generator direct connected 17" x 24" Elliott Unaflow non-condensing engine, 175 lb. pressure, 6 lb. gauge back pressure.

ENGINE-GENERATOR UNITS

3 phase, 60 cycle—Alternating Current (Cont.)

MOTOR GENERATORS

1500 KW Allis-Chalmers, 600 volt direct current generator direct connected to 2190 HP, 3 phase, 60 cycle, 4000/6600 volts, 300 RPM synchronous motor.

100 KW Triumph 250 volts direct current generator direct connected to 150 HP, 3 phase, 60 cycle, 2300 volts, 900 RPM squirrel cage motor.

MOTORS

3 phase, 60 cycle

1500 HP Allis-Chalmers, 2300 volts, 200 RPM slip ring.

625 HP G.E. type ATI, 2200 volts, 257 RPM synch.

620 HP G.E. type ATI, form S, 440 volts, 164 RPM synchronous.

150 HP (5) G.E. form K, 2200 volts, 580 RPM, in the 4 million series, each complete with G.E. automatic compensator.

125 HP 80% P.F. Elec. Mchy. 440 volts, 400 RPM synchronous with starting equipment.

50 HP G.E. type I, form M, 2200 volts, 1200 RPM slip ring.

50 HP Allis-Chalmers, 440 volts 600 RPM squirrel.

MISCELLANEOUS

1200 KVA G.E. 3 phase, 60 cycle, 2400 volt, 300 RPM alternating current generator direct connected to a 1700 HP, 3 phase, 25 cycle, 2300 volt synchronous motor.

500 KVA G.E. 3 phase, 60 cycle, 2300 volts, 450 RPM belted alternating current generator.

522 HP water tube boiler, A.S.M.E. code, 210 lb. pressure complete with stoker and accessories. New 1927.

500 KVA Ideal, 3 phase, 60 cycle, 240 volts, 400 RPM, three-bearing belted type generator with direct connected exciter and rheostats.

200 KVA Westinghouse, 3 phase, 60 cycle, 240 volts, 200 RPM engine type generator with rheostat.

30 KW G.E. 125 volts, 625 RPM, type RC compound wound direct current generator.

1—Elliott jet condenser with auxiliaries suitable for a 5000 KW turbine-generator unit.

1055 cubic feet, 100 lb. air pressure Chicago Pneumatic horizontal compressor direct connected to 170 HP 240 volt, 150 RPM General Electric direct current motor.

Synchronous Condensers 1350 KVA Total Capacity

750 KVA and 600 KVA General Electric, type ATI, 3 phase, 60 cycle, 240 volts, 900 RPM synchronous condensers. Each unit complete with direct connected exciter, switchboard panel with instruments. Are in A#1 operative condition—still on original foundation for operating test.

Utilities Electrical Machinery Corporation

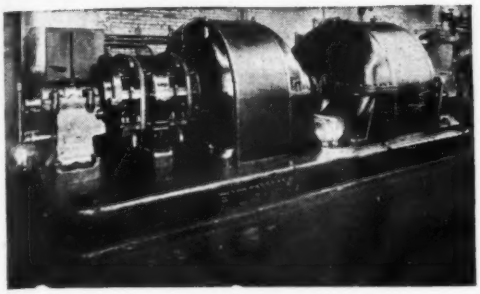
600 NATIONAL CITY BANK BLDG.
CLEVELAND, OHIO

WIRE OR PHONE
LONG DISTANCE 422

The HEAT is on— America needs more POWER

and HERE IT IS READY FOR SHIPMENT

TURBO GENERATOR SETS



1—750 KW Ridgway, 1800 RPM turbine, mixed pressure 135# Gauge 15# Absolute with C H Wheeler 2 Pass surface condenser, direct coupled to a 240 Volt DC Generator 750 KW 1800 RPM.

1—GE 1000 KW Turbine 125# pressure, condensing with jet condenser, direct connected to 1000 KW generator, 3 PH. 60 Cyc. 2300 Volt 3600 RPM.

GENERATORS 230 V. DC

40 KW CR. Whlr. CCD 1085 RPM.
45 KW Diehl K 18 550 RPM.
100 KW Ft. Wayne MPL 550 RPM.
100 KW GE MPL 600 RPM.
200 KW Sprague 525 RPM.
200 KW West. 500 RPM.
250 KW West. 500 RPM.

PUMPS

2—Davidson 14 x 9¼ x 16 Simplex. Double acting Piston pattern, brass fitted.
1—Warren 12 x 7 x 12 Duplex brass fitted.
1—Warren 12 x 8½ x 12 Duplex brass fitted.
1—Warren 14 x 8½ x 12 Duplex brass fitted.
1—Beake 14 x 8½ x 10 Simplex
2—Worthington 6 x 8 Hydraulic.

STORAGE TANKS

1—5' x 18' x ⅜" Horizontal, Riveted, flat ends, manhole on top, 8 outlets & inlets.
1—350,000 Gal. Water Storage Vertical, 40' x 40'.

BOILERS

3—800 HP B & W Straight Tube Waste Heat Boilers, 200 lbs. pressure, complete with Economizers, motor driven induced draft fans, and steel stacks.

2—800 HP Edgemoor Waste Heat Boilers, 200 lbs. pressure complete with Economizers, Super Heaters, motor driven blowers and steel stacks.

2—400 HP B & W Straight Tube Water Tube Boilers, 200 lbs. pressure complete with Combustion Engineering Type E stokers and induced draft fans.

2—253 HP Heine Water Tube Boilers, 160 lbs. pressure, ASME code.

COMPLETE BOILER PLANT

New 1934

Consisting of:

3—167 H.P. Wickes H.R.T. Boilers, 150 lbs. press. A.S.M.E. code. Each complete with Combustion Engineering Type E underfeed motor driven stoker.

2—10x6x12 Duplex boiler feed pumps.

1—Cochrane feed water heater.

Complete monorail system for handling coal and ashes with two AC hoists.

CONDENSER

1—C. H. Wheeler 3650 Sq. Ft. Surface Cond. 2 pass, complete with pumps.

COAL PULVERIZERS

2—Fuller Lehigh Pulverizers Jeffreys 24 x 24 Coal Crusher, Ruggles 6' x 30' Rotary Dryer, Conveyors, elevators, etc.

•TUBES

CONDENSER TUBES
7,500 Condenser Tubes
1" OD 20 Gauge
Admiralty 18 ft., long
like new

BOILER TUBES
212 New Seamless
3½" 10 ga. boiler tubes
17'1" long.

Thousands Feet of Conduit ¾" to 3"

★MOTORS★

230 V. DIRECT CURRENT

Q.	H.P.	Make	Type	R.P.M.
1	150	WSGHSE	SK	1750
1	125	GEN. ELEC.	DLC	550
		3 PH. 60 CYCLE AC 220/440 VOLT		
		SQUIRREL CAGE		
1	125	Cr. Wh.	125Q	900
1	50	GEN. ELEC.	KT327	1800
1	50	WAGNER	22VRM	600
		SLIP RING		
2	150	Al. Ch.		600
1	150	WSGHSE	H.F.	495
		SYNCHRONOUS		
1	450	WSGHSE	550	600
1	268	GEN. ELEC.	2300	600
1	125	WSGHSE	2400	900

Hundreds of other motors from 1 HP up.

Write for Bulletin #P-100

HEAT and POWER Company, Inc.

45 BOND STREET **Phone: ALgonquin 4-3874** **NEW YORK, N. Y.**

DEPENDABLE

Turbo-Generators

A PARTIAL LIST OF OUR INVENTORY

1—G.E. 3125-KVA, 3600-RPM, Condensing: 3/60/2300-v, 200#, 100° SH, 28" vacuum: Surface or Low Level Jet Condenser.

1—Westinghouse 2500-KVA, 3600-RPM, Condensing: 3/60/600-v, 200#, 100° SH, 28" Vacuum: Low Level Jet Condenser.

1—G.E., 1875-KVA, 3600-RPM, Condensing: 3/60/600-v, 200#, 100° SH, 28" Vacuum: Surface or Jet Condenser.

1—G.E., 1563-KVA, Non-condensing 3600-RPM, 3/60/600-v: 150#, 100° SH, 20# back pressure.

1—Allis-Chalmers 1250-KVA, 3600-RPM, 3/60/2300-v, 200#, 500° TT: Surface Condenser.

1—Westinghouse, 1250 KVA 250-v, direct current, condensing, 150/250-Lbs., Surface Condenser.

1—Allis-Chalmers 937-KVA, 3600-RPM, Condensing: 3/60/2300-v, 200#, 500° TT: Surface Condenser.

1—G.E., 625-KVA, 3600-RPM, Condensing: 3/60/2300-v, 200#, 500° TT, 28" vacuum.

1—G.E., 250-KVA, Non-condensing, 3600-RPM: 3/60/480-v, 150#, 0° SH, 28" Vacuum, 10#G, back pressure.

WILMS, WEAVER & CO. Penobscot Building DETROIT, MICH.

We Deal in Turbo-Generators Exclusively

POWER PLANT EQUIPMENT CO., INC.

39 Cortlandt Street
New York, N. Y.

A C TURBINE UNITS

6250 KVA G.E. 2300 V. Cond.
1875 KVA Al. Chal. 2300 V.; Cond.
937 KVA Al. Chal. 2300 V.; Cond. (300#))
937 KVA G.E. 2300 V.; Cond.
780 KVA Al. Chal. 2300 V.; Cond.
625 KVA Wghse. 2300 V.; Cond.
500 KVA Wghse. 480 V.; Non-Cond.
375 KVA G.E. 2300 V.; Cond.
375 KVA G.E. 2300 V.; Non-Cond.
312 KVA Elliot 480 V.; Cond.
312 KVA C.W.-Moore, Non-Cond. (450#)
175 KVA Al. Chal.-Sturtevant 220 V.; Non-Cond.

STEAM ENGINE SETS

375 KVA G.E.-E.B. 4 Valve; 480 V.
300 KW G.E.-Skinner Uniflow; 250 V. DC
255 KVA G.E.-Hamilton Corliss; 240 V.
210 KVA G.E.-Skinner Uniflow; 480 V.
200 KW G.E.-Skinner Uniflow; 125 V. DC
200 KW G.E.-E.B. 4 Valve; 125 V. DC
150 KVA G.E.-Skinner; 220 V.
125 KW G. E.-E.B. 4 Valve; 250 V. DC
100 KW G.E.-E.B. 4 Valve; 250 V. DC
100 KW G.E.-E.B. 4 Valve; 125 V. DC

STEAM ENGINES

Twin 22 x 36 Nordberg Uniflow
18 x 20 Ames Uniflow

SPECIAL — 937 KVA GENERAL ELECTRIC 3-60-2300 V. CONDENSING TURBO GENERATOR SET; EXCITER; SURFACE CONDENSOR; SWITCHBOARD.
500 KVA Wghse. 3-60-480 V. Non-Cond. Turbine Unit, Exciter, Switchboard.
210 KVA G.E. 3-60-480 V. Alternator-19x20 Skinner Uniflow Engine; Exciter, Switchboard.

COAL PULVERIZERS

8000 lb. Fuller-Bonnet
4500 lb. (2) Erie City Unitype

DIESEL ENGINE SETS

375 KVA Wghse. 3 ph., Busch-Sulzer
312 KVA Burke 3 ph.—Anderson
200 KVA G.E. 3 ph.—Busch-Sulzer
170 KVA F.M. 3 ph.
60 KVA (2) G.E. 3 ph.—Tipps
40 KVA F.M. 3 ph.
50 HP F.M. "VA" belted

TRANSFORMERS

687 KVA (2) Maloney 13,800-460 V.
500 KVA (3) Al. Chal. 33,000-440 V.
250 KVA (3) Packard 22,000-2300 V.
200 KVA (3) G.E. 2400/4160-600 V.
150 KVA (2) Maloney 2300-230/460 V.
100 KVA (3) Al. Chal. 22,000-440 V.
30 KVA (4) Packard 6600-110/220 V.

HEATERS

240,000 lbs. Griscom-Russell
170,000 lbs. Hoppes

BOILERS

749 HP (4) Edgemoor 200 lb.
728 HP E.C. ver. 200 lbs.
600 HP Heine 200 lbs.
600 HP Connelly 200 lbs.
600 HP (3) Sterling 200 lbs.
500 HP (4) Vogt 225 lbs.
471 HP E.C. ver. 160 lbs.
250 HP (2) E. C. 200 lbs.
344 HP (2) B & W 160 lbs.
205 HP Heine 165 lbs.

SURFACE CONDENSOR

625 Sq. Ft. Wheeler

AIR COMPRESSORS

2200 CFM Nordberg 100#—Motor & Steam Driven
250 CFM Penn 150#—Motor Driven

PUMPS (motor driven)

3600 GPM 85' head
3000 GPM 100' head
850 GPM 243' head
750 GPM Hill 231' head
650 GPM DeLaval 810' head
600 GPM Al. Chal. 450' head

STOKERS

Combustion Engineering for 250 HP
Illinois Chain Grate (2) for 350 HP
Westinghouse for 700 HP
Illinois Chain Grate for 1300 HP

"ELECTRIC EQUIPMENT" STOCK-LIST

MOTORS

25 CYCLE MOTORS

Alternators—Synchronous Motors

3 Phase, 25 cycle

HP	KVA	Make	Type	Volts	RPM
600	KVA	G.E.	ATI	550	500
300	HP	Elec.	Mach.	440	214
100	HP	Elec.	Mach.	440	600
75	HP	Elec.	Mach.	2200	500
20	KW	Ideal		240	1500

SQUIRREL CAGE

220-440 volt 3 phase

HP	Make	Type	Volts	RPM
300	G.E.	I-K	440	1500
150	G.E.	I-K	440	750
150	West.	CS	440	1500
125	G.E.	Kt 561	440	750
100	West.	CCL	440	500
100	G.E.	I-K	440	750
75	G.E.	I-K	440	750
75	G.E.	I-K	440	500
60	Lincl.	IN	220	1500
50	G.E.	I-K	440	750
50	G.E.	KT 353	440	750
50	F-Morse	H-16B	440	750
50	West.	CS	440	750
40	West.	CS	440	750
40	G.E.	KT 343	440	750
40	Al.-Ch.	AN	440	1500
40	G.E.	KT 337	440	1500
35	G.E.	I-K	440	750
35	West.	CS	440	750
35	G.E.	I-K	440	1500
30	Wagn.	22 VBP	220	750
30	G.E.	KT	440	750
30	G.E.	KT 343	440	750
30	West.	CS Tot. En.	440	750

Also 150 motors from 20 HP. to 1 HP. all speeds.

SQUIRREL CAGE

2200 volt AC 25 cycle, 3 phase

HP	Make	Type	Volts	RPM
100	G.E.	I-K	2200	1500
100	G.E.	KT 553	2200	1500
100	West.	CCL	2200	500
75	West.	CS	2200	750
50	West.	CS	2200	750
50	Al-Ch.	AR 226M	2200	1500
50	G.E.	I-K	2200	1500
40	West.	CS	2200	750
35	I-K	G.E.	2200	500
30	G.E.	KT 337	2200	750
30	West.	CS 753	2200	750

SLIP RING

3 phase, 25 cycle

125	Al-Ch.	AN	440	750
125	G.E.	I-M	440	1500
100	G.E.	I-M	2200	375
100	G.E.	MT 357	440	1500
75	G.E.	I-M	2200	750
75	G.E.	I-M	2200	500
75	West.	CI 756A	440	500
60	West.	CW 765A	440	750
50	Al-Ch.	ANY	220	380
50	G.E.	I-M	440	750
50	West.	CW	440	750
40	West.	CW	440	750
37	G.E.	ITC 5015	220	750
30	Al-Ch.	ARY	440	1500
25	G.E.	MT 337	220	750

25 other motors smaller than 25 HP In Stock.

60 CYCLE MOTORS

SQUIRREL CAGE

HP	Make	Type	Volts	RPM
200	G.E.	I-K	2200	600
200	West.	CS	2200	1200
150	G.E.	I-K-16	2200	600
150	Al-Ch.	AN	2200	900
150	Al-Ch.	AR	440	900
150	G.E.	I-K	2200	1200
150	West.	CS	440	1800
150	G.E.	I-K 13A	2200	1800
125	Tmph.	TR 14	440	1800
125	G.E.	I-K	4150	450
100	G.E.	I-K	2200	720
100	G.E.	KT 556	2200	900
100	G.E.	I-K	440	900
100	Al-Ch.	AR 226D	440	900
100	G.E.	KT 543	440	1200
100	G.E.	I-K	440	1800
75	G.E.	KT 552	2200	900
75	G.E.	KT 352	440	900
75	Howell	SC	440	1800
75	West.	CS	440	1800
75	Ideal	A306 B.B.	440	3600
60	G.E.	KT 333	440	1800
50	G.E.	I-K 15A	440	300
50	G.E.	I-K	440	720
50	G.E.	KT 542	550	900
50	G.E.	KT 336	550	1200
50	G.E.	KT	440	1800
50	F-Mse.	HO121C	440	3600
50	G.E.	KT 527	2200	1800
50	F-Mse.	B.B.	2200	3600

200 Motors 30 HP. and smaller all speeds and types in stock

SLIP RING

400	G.E.	I-P	2200	257
300	G.E.	I-M	2200	1200
200	G.E.	I-M 17A	440	514
200	G.E.	I-M 17	550	514
200	G.E.	I-M 17	2200	600
150	G.E.	I-M 16	2200	600
150	G.E.	I-M 16	550	600
150	West.	CW	2300	720
150	Cr-Wh.	Late	440	900
150	G.E.	I-M	2200	900
150	G.E.	I-M 15	440	900
150	West.	CW 771.1c	440	1800
125	G.E.	MT 547	2300	1800
112	G.E.	ITC 5015	550	514
100	G.E.	MT 356	440	900
100	G.E.	I-M	440	900
100	G.E.	I-M	440	1800
75	Al-Ch.	ANY	440	514
75	G.E.	MT 556	550	720
75	G.E.	MT 356	2200	720
75	G.E.	I-M	220	1800
60	G.E.	MT 556	440	600
60	G.E.	MT 352	440	720
60	G.E.	MT 346	440	900
50	G.E.	I-M	440	514
50	G.E.	MT 352	2200	720
50	G.E.	MT 352	220	720
50	G.E.	MT 346	2200	900
50	G.E.	I-M	440	1200
50	G.E.	MT 536	440	1200
50	West.	CW	440	1800
50	G.E.	I-M	440	1800

50 Smaller slip ring motors 15 HP. and smaller any speed.

DIRECT CURRENT MOTORS

CONSTANT SPEED—115 volt

HP	Make	Type	RPM
100 KW.	G.E.	DLC	1000
75 KW.	G.E.	CD 145	720
75	Sprague	LC	700
60	Rel.	Intpl.	1200
20 KW.	G.E.	DLC	650
20	G.E.	RC 31	1200
20	G.E.	RC 30	1150
15	G.E.	CVC 116	700
15	G.E.	CVC 115	925
15	W.S.H.	SK	1150
15	G.E.	RC 29	1200
10	West.	SK	1120

50 Motors—115 volt—10 HP. and under, all speeds.

VARIABLE SPEED—115 volt

30	Nthn.	20801	250/1000
25	West.	SK	1100/2200
15	G.E.	RC 12	575/1150
15	West.	SK	1110/1650
10	West.	SK 91	250/1000
7½	G.E.	RF 9	600/1800
7½	G.E.	RA 30	650/1300
5	G.E.	RF 8	650/1950
2	G.E.	CD 73	500/2000

CONSTANT SPEED—230 volt

300	G.E.	DMC 1NT	800
100	G.E.	CD 123	1200
75 KW.	Cr. Wh.	81 H Gen.	725
75	Cr. Wh.	516761	1050
60	G.E.	RC 34	1050
60	Al-Ch.	E 123	1800
60	West.	SK 123L	1800
50	Cr. Wh.	CMC-H50	750
50	Rinc.	310T	900
50	Al-Ch.	E 123	1200
40	G.E.	RC 15	700
40	G.E.	RC 31	700
40	West.	SK	775
40	G.E.	LC	930
40	G.E.	RC	1050
40	G.E.	DLC	1050
40 KW.	West. gen.	SK	1800
35 KW.	G.E. gen.	DLC	900
30	West.	SK 133	600

Also 130 other DC motors—40 HP. and smaller any speed.

VARIABLE SPEED—230 volt

175	G.E.	DLC 208	650/ 925
80	Burke	CD 60	200/ 625
60	Sprg.	Intpl.	480/1100
50	G.E.	RLC	400/1200
35	West.	SK	500/1500
35	G.E.	RLC	500/1500
35	West.	SK 150	400/1200
35	G.E.	RF 14	400/1200
30	West.	SA 8	500/1500
30	El. Dy.	208	400/1200
25	West.	SK 140	400/1200
25	El. Dy.	208	400/1200
20	West.	SK	400/1200
20	G.E.	RLC 115	600/1200
20	G.E.	RLC 203A	300/ 900
15	West.	80 L	1150/1800
15	G.E.	RF 13	300/ 900
15	West.	SK 93	600/1800

45 motors, 230 volt DC variable, all speed, 13 HP. or smaller.

MOTOR GEN. SETS

250 Volts DC.

1—300 KW. Al. Ch. late factory built set, 250 v., 900 rpm. comp. intpl. on base to 710 KVA. Al. Ch. synch. motor, 2300 v., 60 cy., 3 ph. 900 rpm. with panels.

150 KW Ridgeway 900 speed 2300/60/3/900.

1—100 KW. Cr. Wh. factory built set 275 v. DC. 1800 rpm. comp. intpl. on base to 150 HP. Type SC Cr. Wh. motor, 2200 v., 60 cy., 3 ph., 1800 rpm. with starter.

1—50 KW. G. E. type RC, 250 v., 900 rpm. on base to 75 HP. KT 552 motor 2200 v., 60 cy., 3 ph., 900 rpm.

125 volt DC.

1—75 KW. G. E. type RC 18, 125 v., 720 rpm. comp. intpl. factory built to 115 HP. G. E. type I-K, sq. cg. motor, 2200 v., 25 cy., 3 ph., 750 rpm. with starter.

1—35 KW. G. E. type CD 95, 125 v., 1800 rpm. factory built comp. intpl. to 50 HP. G. E. type FT 527, sq. cg., 2200 v., 60 cycle, 3 ph., 1800 rpm. complete.

1—30 KW. West. type SK factory built, 125 v., 1200 rpm. to 50 HP. West. type CS 440 v., 60 cy., 3 ph. 1200 rpm. motor, complete.

1—17 KW. G. E. type CVC set, 125 v. 1200 rpm. comp. intpl., to a 25 HP. G. E. type I-K, sq. cg. motor, 550 v., 60 cy., 3 ph., 1200 rpm.

We also have 15 Mo. Gen. Sets 15 KW. and smaller, 125 v. or 250 v. Send us your inquiries.

LOW VOLTAGE

1—850 Ampere G. E. type CD factory built, 32 v., 1200 rpm. comp. intpl. on base to 40 HP. G. E. type KT 532 motor, 440 v., 60 c., 3 ph., 1200 rpm.

1600 Amps. 60 V. G.E. 1200 speed—AC or DC Drive.

AC GENERATORS

60 CYCLE

HP	KVA	Make	Type	Volts	RPM
300	KVA.	G.E.	ATB-PB	480	720
250	HP.	West.	4846672	240	1800
240	HP.	G.E.	ATI	200	514
225	KVA.	G.E.	ATB	220	720
200	KW.	G.E.	ATB-PB.	550	720
200	HP.	G.E.	ATI syn.	2300	900
150	KW.	West.	640451	2200	600
150	KW.	G.E.	ATI	2300	900
150	KW.	G.E.	ATB-PB	600	900
120	KW.	G.E.	ATB-PB	2300	720
105	HP.	El.Ma.	BRT	2300	1800
100	HP.	G.E.	ATI PB	2300	900
100	HP.	G.E.	ATI-PB	220	900
75	KW.	G.E.	ARB-PB	2300	900
75	KW.	G.E.	ATB-PB	550	900
60	KVA.	G.E.	ATB-P	2300	900
60	HP.	G.E.	ATI-PB	4000	900
54	KVA.	G.E.	ATB	220	900
50	KW.	G.E.	TRB	240	1200
50	KVA.	West.	Ac gen.	240	1200
37½	KVA	G.E.	ATB-PB	240	1200
25	KW.	G.E.	TAB	240	1800

40 Generators AC. in stock 20 KW. or smaller. Write for details.

1250 HP IDEAL, 4000/2300 Volt, 1200 RPM, Direct Conn. Exciter

SPECIALS

BOILERS:
3—150 HP. Wickes H.R.T.

STOKERS:
3—Combustion Engine Ring.

TRANSFORMERS:
70—50 KV. G.E. 2300/115/230

ENGINE GENERATORS:
1—625 KV. Corliss 220 V., 60 cy.
250 KW. Corliss 230 V. D.C.
1000 KW Penn-West. 250 V. D.C.

OUR STOCK INCLUDES THE FOLLOWING

TRANSFORMERS	SAFETY SWITCHES	CAPACITORS
METERS	PANEL BOARDS	COMPENSATORS
MOTORS	ALTERNATORS	GAS ENGINES

We will buy for cash and resell to defense plants.

ELECTRIC EQUIPMENT CO.

680 LAKE AVE. PHONE: Glenwood 6783 ROCHESTER, N. Y.

MOTORS • GENERATORS • TRANSFORMERS

Prices on Application

3 PHASE, 60 CYCLE, 220/440 V.

HP	Make	RPM	Type	Frame
5	West.	1200	CCL	2 phase
5	American	600	totally enc.	ball bearing
7½	Gen. Elect.	1800	KT	944
7½	Gen. Elect.	1800	KQ	944 2 phase
10	Fairbanks Morse	900	KBY	
10	Crocker Wheeler	900	Nema	365
10	Burke	1800		
15	Reliance	1200		2 phase
15	Howell	900		2 phase
20	Gen. Elect.	1800	KQ501	2 phase
20	Gen. Elect.	565	I	Form K
25	Gen. Elect.	1740	KQ312	2 phase
25	Armor	1200	ball bearing	2 phase
25	Gen. Elect.	1800	KT	312
30	Gen. Elect.	3600	KT	513
30	Armor	695	ball bearing	2 phase
50	West.	1200	MS	
50	Fairbanks Morse	1800	ball bearing	
50	Fairbanks Morse	1800	ball bearing	
50	West.	1800	CS	
60	Gen. Elect.	1800	I	form K
75	Gen. Elect.	1800	I	form K
75	Gen. Elect.	900	KT	552
100	Gen. Elect.	1800	I	form K
100	West.	1800	CS	
150	Gen. Elect.	1200	I	form K
150	Gen. Elect.	1200	I	form K

MOTOR GENERATOR SETS

1—125 KW Ridgeway 250 V. DC. 1200 RPM Motor 3/440/60/1200 Complete.

1—100 KW Westinghouse Synchronous-Generator 250-275 V. DC.—Motor 3/60/2300/900 RPM complete with panels.

1—32 KW Westinghouse M. G. Set. Generator Type SK, 250 V. DC. 1750 RPM—Motor 49 HP. Type CS. 3/220/440/60/1750 RPM complete with panels.

ENGINE TYPE MOTOR
625 Hp. Gen. Elect. Synchronous 3 Ph. 60 Cy., 2300 Volt, 180 Rpm.

Mine Slope Hoist

1—Connellsville Mfg. and Mine Supply Hoist —Storage capacity for 11,000 feet 1" Rope— Speed 900' per minute.
Motor—500 HP Gen. Elect. Mt. Sliprng 3/60/2200/450 RPM. Complete with remote control, Herringbone reduction gears and demountable base and drum.
Write Wire Phone
Inspection can be made for 30 days in operation. This machine almost new.

TRANSFORMERS

Amt.	Kva.	Make	Cycle	Voltage
3	25	Gen. Elect.	25	2300/115/230/460
3	40	Gen. Elect.	25	2300/230/460
3	50	Gen. Elect.	60	2300/230/460
3	250	Gen. Elec . (new)	60	13,200/2300
3	200	Kuhlman	60	4160/4600/230/460
3	500	Pittsburgh	25	11,500/220
3	1000	Pittsburgh	60	2300/4600/230/460

3 PHASE, 25 CYCLE, 220/440 VOLTS

HP	Make	RPM	Type	Frame
5	Al. Chal.	720	AR	
5	Wagner	1450	Ball B.	Enclosed
7½	West.	750	CS	
7½	G. E.	1500	KT	181
10	G. E.	750	KT	312
10	West.	750	CS	
10	West.	1500	CS	
10	G. E.	1500	I	Form K
15	G. E.	750	KT	
15	West.	1500	CS	
20	West.	750	CS	
25	West.	750	CS	
50	G. E.	750	I	Form K
50	West.	750	CS	
75	G. E.	750	KT	357
75	G. E.	750	I	Form K
100	G. E.	300	I 17	Form K
150	G. E.	750	I	Form K
150	G. E.	750	I	Form K
200	West.	460	CS	2200 Volt
200	G. E.	750	I	Form K
225	Elec. Ma.	500	2200 V.	Synchron
1150	G. E.	375	2300 V.	Synchron
200	West.	235	CW	Slipring

Prices on Application

SLIPRING MOTORS

60 CYCLE, 3 PHASE, 220/440 VOLTS

HP	Make	Speed	Type	Frame
10	Gen. Elect.	1800	MT	303
15	Gen. Elect.	1800	I	form M
20	Gen. Elect.	545	MT	332
20	Westinghouse	575	CW	648A
20	Westinghouse	575	CW	ball bearing
25	Westinghouse	690	CW	
30	Gen. Elect.	1800	MT	327
30	Gen. Elect.	1800	I	form M
40	Westinghouse	690	CW	748
40	Westinghouse	690	CW	748A
40	Westinghouse	690	CW	748A
40	Westinghouse	690	CW	748A
50	Westinghouse	900	CW	
60	Westinghouse	720	CW	2200 volt
75	Westinghouse	1800	CW	
500	Westinghouse	600	CW	

25 Cycle Steel Mill Motors

Amt.	HP	Make	RPM	Type	Voltage
1—	225	Elect. Mach.	500	Synchronous	2300
2—	750	Gen. Elect.	125	Slip Ring	2300
1—	1000	Allis Chalmers	293	Slip Ring	6600
1—	1150	Gen. Elect.	375	Synchronous	2300
1—	1250	Allis Chalmers	294	Slip Ring	6600
4—	1600	Gen. Elect.	93	Slip Ring	2300
1—	2000	Allis Chalmers	294	Slip Ring	6600
1—	2500	Allis Chalmers	295	Slip Ring	6600
1—	2500	Allis Chalmers	146	Slip Ring	6600
1—	3000	Allis Chalmers	184	Slip Ring	6600
1—	5500	Allis Chalmers	370	Slip Ring	6600

FREQUENCY CHANGERS

2—1250 KVA Gen. Elec. Synchronous—motor 3/25/ 2200 750 RPM. direct connected to Generator 3/62½/440 V. Complete with exciters and panels.

1—200 KW General Electric 3 ph., 60 cy., 2300 V. direct connected to 290 HP. Gen. Elec. Synchronous Motor, 3 ph., 25 cy., 440 volt, 750 RPM. Complete with panels.

25 CYCLE CRANE MOTORS
10—25 Hp. Gen. Elect. New MTC 5523. 3/25/440/750 Rpm.

ERIE ELECTRIC CO., INC.

124 CHURCH ST. BUFFALO, N. Y. CL. 4758

CHICAGO'S LARGEST AND MOST COMPLETE STOCK

MOTOR-GENERATOR SETS

KW	Make	DC Volts	AC Volts
750	Wtg.	275	syn. 3/60/440
150	Ideal	250	ind. 3/60/440
100	Wtg.	250	ind. 3/60/220
100	G.E.	250	ind. 3/60/2200
100	Wtg.	125	ind. 3/60/2200
90	Wtg.	110	AC gen. 3/60/2300
60	Al.Ch.	110	ind. 3/60/2200
75	G.E.	125	ind. 3/25/440
75	G.E.	250	ind. 3/60/440
75	G.E.	250	syn. 3/60/2200
75	G.E.	125	ind. 3/25/220
75	G.E.	125	syn. 3/60/220
25	Chandvs.	125	ind. 3/60/220
22½	G.E.	125	ind. 3/60/220
20	G.E.	230	ind. 3/60/230
15	Ideal	220	ind. 3/60/220
18	Wtg.	60	ind. 3/60/550
12½	G.E.	115/230	3/60/220

ADJUSTABLE SPEED D.C. 230 V.

H.P.	Make	Type	Speed
50	G.E.	C	575/1000
35/100	G.E.	CD-165Y	425/900
40	Chandys.	F-16	860/1150
35/25	G.E.	WT C203L	400/600/1000
35	Cr. Wh.	CM	375/960
35	Jantz-L.	EI	560/860
25	Wtg.	S-9	560/780
25	G.E.	DLC-25	500/1000
15	G.E.	CE	650/950
10	G.E.	LC	1000/1500
10	Reliance	92T	600/1200
15	G.E.	Canadian	700/1400
7½	Wtg.(550)	SK-48	1150/1725
7½	Reliance	46T	875/1900
5	Burke	WAM12 (2)	650/1950
5	Ft. Wayne	BRG	550/850
5.5	Westg.	3-S	975-1500
3.3	Westg.	SK-23	1300/1800
3	G.E.	CD-55	1050/1700
4	G.E.	C	800/1400
2½	Cr. Wh.	CCM	920/1175
2/3/4	G.E.	RC-4	1700/1800
2.25	Roth	2S	1550/1780
2.2	G.E.	RC4	600/1000
		115 V.	
60	G.E.	C	500/1000
20	G.E.	LC	500/1000
20	Triumph	32F	250/1000

PUMPS

Can furnish with motor

GPM	Head	Make	Type
800	325	American	KT4MB
150	80	Gould (2)	#3030
50/100	230	Gould	#1616
150	250	Swaby	#1961
400	100	Haydon	
900	70	Union	19TBI'
10/40	120/70	Yeomans (2)	HVS
25/50		Economy	15/20#
125	180	Jennings	7#2
100		Blackmer gasoline pump	#100

FREQUENCY CHANGERS

1000 KW General Electric 3/60/460 volt AC generator .8 p.f. 300 RPM with 1400 HP G.E. type ATI .9 3/60/460 b. 400 RPM .9 p.f. motor. 3-pedestal bearing unit amort. wdg. both ends with 33 KW exciter.

90 KW GE adj. unit. 60 HP 3/60/ 220 4-speed motor, with comp. pole changing sw. rated 90 KW 60/120 cy. 68 KW 60/90 cy. 70 KW 60/ 100 cy. 60 KW 60/80 cy.

25 CYCLE M.G. SETS

75 KW G.E. CL-6 125 v 2-brg. with 110 HP I-K 3/25/220 ind.

75 KW GE DLC-206A intp. 3-brg. with 115 HP I-K 3/25/440 ind.

BOILERS

1—800 hp. B & W 225 lbs.
3—300 hp. B & W 160 lbs.
1—205 hp. Heine water tube 150#
2—492 hp. Sterling 160 lbs. with stoker.
1—312 hp. Sterling 100 lbs with stoker.
1—516 hp. Stirling 200 lbs. with stoker.

BOILER FEED PUMPS

1—16x10x12 Union Vacuum Pump. brass lined cylinders, force feed lubricator.
1—8½x5x10 Union boiler feed pump, brass lined cylinders, force feed lubricator.

ROTARY CONVERTERS

165 KW G.E. type HCC-6-165, comp. wd. intp. 6/60 AC 250 v. DC. 1200 RPM, 440 v. transfs.
50 KW N.W. 3/60/220 1200 RPM AC to 115 v. DC.

SLIPRING CONTROL

500 HP G.E. autom. type MTC209A, 3/60/2200, 9-sec. 4-stage panel DL128712, Diag. 30069, open.
500 HP G.E. autom. type CR2124, sec. panel, 9-sec. 3/60/2200 V. mine hoist service.

VERTICAL A.C. MOTORS

2-60	Wtg. CS	3/60/2200	1750
7½	F.M. H	3/60/220	3600
7½	G.E. KT	3/60/220	1150
5	Wag. (3)	3/60/220	1725
7½	Wag. (2)	3/60/220	1725
5	Kimble	3/60/440	1200
5	Wtg. bb	3/60/220	850

AIR COMPRESSORS

12x10 Chgo. Pn. NSB 300 CFM 100#.
Ingersoll-Rand ERI 93 CFM 100#.
Bury, 1220 CFM 30# class DCB.

FIRE PUMP MOTORS D.C.

75 HP Northwestern 230 V. 1750 RPM.
100 HP Gen. Elec. 230 V. 1640 RPM.

TRANSFORMERS

No.	KVA	Make	Volts
1	125	Kuhl.	1/60 2300/125
1	100	G.E.	3/60 9000Y/230
1	90	Kuhl.	1/60 440/1.5-6
5	75	Wstg.	1/60 3810/244/122
2	75	Wstg.	1/60 3810/244/122
1	75	Darl.	1/60 10/250
1	30	Kuhl.	3/60 220/55-100
1	15	Ft.W.	1/60 1050-2100/2200-288
1	10	Mol.	1'60 1100-2200/220/440
1	7½	G E.	1/60 1100-2200/244/488
1	7½	G.E.	3/60 2200-4000/230/460
1	7½	G.E.	3/60 6600Y-230
1	7½	Pitts.	1/60 2200/110/220
1	7	Kuhl.	1/60 430-460/1-1.5-2
1	6	Sorg.	3/60 140/220
1	6	Kuhl.	1/60 160-5:1
1	5	G.E.	1/60 1100/2200/220/440
1	5	G.E.	1/60 1100/2200/110/440
1	3	G.E.	1/60 460/55-110
1	3	Mol.	1/60 1150/115-230
1	3	Mol.	1/60 2200/110-220
1	1.5	A.Ch.	1/60 2200/115-230

2200 VOLT COMPENSATORS

3 Phase, 60 Cycle

HP	Make	Type
150	Gen. Elec.	NR 4747
150	Gen. Elec.	CR 1034-K17
125	Westinghouse	A
125	Gen. Elec.	CR 1034-K17
75/100	Westinghouse	E
100	Gen. Elec.	NR 2724
75	Westinghouse	E
75(3)	Gen. Elec.	NR 2723
75	Gen. Elec.	CR 1034-K17
75	Gen. Elec.	NR 2742
60/75	Gen. Elec.	NR 6693-N13
60	Gen. Elec.	CR 1034-K17
30/50	Westinghouse	E
40/50	Westinghouse	E (2 of these)
50	Gen. Elec.	CR 1034-K17
50	Allis Chal.	RD-31
40	Gen. Elec.	NR 5032-N13
30/40	Allis Chal.	RD-31
35/40	F. Morse	CCOR
25	Gen. Elec.	NR 2085
60/100	Wtg. autom.	Magnetic (4)

CHICAGO ELECTRIC CO. 1320 W. CERMAK RD. CANAL 2900 CHICAGO, ILL.

THE PICK OF POWER EQUIPMENT

TURBO UNITS—60 Cy.
1—18750 KVA Westinghouse Cond.
1—12500 KVA Westinghouse Cond.
1—12000 KW General Electric Cond.
1— 6250 KVA General Electric Cond.
1— 4000 KW General Electric Cond.
1— 4000 KVA Allis Chalmers Cond.
1— 3125 KVA General Electric Cond.
1— 1250 KVA General Electric Cond.
1— 937 KVA General Electric Cond.
1— 750 KVA General Electric Cond.
1— 375 KVA General Electric Cond.
1— 250 KVA General Electric Cond.
1— 1500 KVA Allis Chalmers Non-C.
2— 1250 KVA General Electric Non-C.
1— 938 KVA West. 375# I.P. 100# B.P. N-C.
1— 625 KVA General Electric Non-C.
1— 312 KVA Moore Non-Condensing
1— 250 KVA Westinghouse Non-C.
1— 125 KVA Westinghouse Non-C.

STEAM ENGINE UNITS—60 Cy.
1—1067 KVA Nordberg Uniflow
1— 325 KVA Skinner Uniflow
1— 300 KVA Hamilton 4-valve
1— 250 KVA Ridgway 4-valve
1— 210 KVA Skinner Uniflow
1— 187 Chuse Uniflow
1— 94 KVA Ridgway 4-valve

DC STEAM ENGINE UNITS
1—300 KW Skinner Uniflow 250 V.
1—350 KW Ridgway 4-valve 250 V.
1—300 KW Skinner Uniflow 250 V.
1—200 KW Ridgway 4-valve 250 V.
1—150 KW Ames Uniflow 125 V.
1—125 KW Ridgway 4-valve 250 V. 3-wire
1—100 KW Ames Uniflow 120 V.
1—100 KW Elliott 4-valve 250 V. 3-wire

OIL & GAS ENGINE UNITS—60 Cy.
1—400 KW West. (gas) 440 V.
1—312 KVA Anderson 2400 V.
1—200 KW Worthington 2300 V.
1—200 KVA Fairbanks Morse VA 2400 V.
1—187 KVA McInt.-Seymour 2300 V.
2—125 KVA Sterling Petrol (gas) 480 V.
1—121 KVA Fairbanks Morse 240 V.
1—49.5 KVA Fairbanks Morse 120 V.
1— 32 KVA Fairbanks Morse 120 V.

WATER TUBE BOILERS
2—1452 HP B. & W. 350-lb., Stokers
1—1150 HP Baderhausen 260-lb.
1— 868 HP Connelly 250-lb., Stoker
4— 750 HP Edge Moor 200-lb.
6— 600 HP Stirling 180-lb., Stokers
6— 600 HP B. & W. 160-lb., Stokers
2— 480 HP Stirling 200-lb.
2— 336 HP B. & W. 200-lb., McClave-Brooks Stokers
1— 253 HP Stirling 180-lb.
1— 250 HP Heine Marine 165-lb.

SYNCHRONOUS MOTORS—60 Cy.
1—1000 HP Westinghouse 2300 V. 720 RPM
1— 750 HP Westinghouse 2300 V. 720 RPM
1— 200 HP General Electric 2200 V. 1800 RPM
1— 175 HP General Electric 220 V. 200 RPM
1— 175 HP General Electric 230 V. 225 RPM
1— 150 HP General Electric 440 V. 164 RPM
1— 100 HP General Electric 2300 V. 240 RPM

INDUCTION MOTORS—60 Cy.
4—3500 HP G. E. slip ring 2300 V. 120 RPM
1— 800 HP West. slip ring 440 V. 353 RPM
2— 800 HP G. E. slip ring 2300 V. 300 RPM
1— 600 HP G. E. sq. cage 440 V. 900 RPM
2— 400 HP G. E. slip ring 3800 V. 1800 RPM
2— 300 HP G. E. sq. cage 440 V. 600 RPM
2— 250 HP G. E. sq. cage 4000 V. 1200 RPM
1— 250 HP G. E. slip ring 2200 V. 450 RPM
3— 50-150 HP West. 2200 V. 343-679 RPM

MOTOR GENERATOR SETS—60 Cy.
1—1500 KW General Electric 600 V. DC
1—1000 KW General Electric 600 V. DC
2— 500 KW General Electric 600 V. DC
1— 75 KW General Electric 125 V. DC

ROTARY CONVERTERS—60 Cy.
1—1500 KW Westinghouse, 250 V.
2—1000 KW Westinghouse, 250 V.
1—1000 KW Westinghouse, 600 V.
1— 750 KW Westinghouse, 600 V.
1— 500 KW General Electric, 250 V.
1— 500 KW General Electric, 600 V.
2— 300 KW General Electric, 600 V.

OIL CIRCUIT BREAKERS
2— 600 A. 73 KV West. G222AS Outdoor
1— 400 A. 73 KV G. E. FK036 Outdoor
6— 400 A. 37 KV G. E. FHK0136 Outdoor
4— 400 A. 34.5 KV Condit D-16-A Outdoor
2—1000 A. 30 KV Kelman CB-76 Outdoor
4— 600 A. 25 KV West. CO-2 Outdoor
2— 600 A. 15 KV Kelman CB-76 Outdoor
1— 600 A. 15 KV G. E. FKO-60-B Outdoor

FREQUENCY CHANGERS
2—3125 KVA West. 25/62½ cy. 750 RPM
1—3000 KVA G. E. 60/25 cy. 300 RPM
1—2500 KVA West. 25/60 cy. 300 RPM
1—1500 KW G. E. 25/60 cy. 300 RPM
1—1250 KVA G. E. 25/62½ cy. 750 RPM
1—1000 KVA G. E. 60/25 cy. 514 RPM
1—1000 KW G. E. 25/60 cy. 300 RPM
1— 750 KVA G. E. 25/60 cy. 300 RPM

SYNCHRONOUS CONDENSERS
1—2000 KVA G. E. 11000/2200 V. 720 RPM
1—2000 KVA C. W. 11000 V. 600 RPM
1—1000 KVA G. E. 2300 V. 900 RPM
1— 500 KVA West. 2200 V. 900 RPM

TRANSFORMERS—1 Ph. 60 Cy.
3— 600 KVA West. 120,000/2300 V.
3— 200 KVA G. E. 66000/13200-22800 V.
3— 500 KVA Allis 33000/480 V.
6— 250 KVA Penn 34500-17250/4600-2300 V.
3— 75 KVA G. E. 33000/13200-11030 V.
2—10000 KVA G. E. 26400/4580 V. 3 ph.
1— 6000 KVA G. E. 26400/2300 V. 3 ph.
1— 6000 KVA G. E. 13200/2300 V. 3 ph.
3— 1500 KVA Pitts. 22000/6600 V.
2— 1000 KVA G. E. 23000-11500/575 V.
4— 667 KVA West. 22000-11000/2300 V.
3— 250 KVA G. E. 22000/11000 V.
1— 5000 KVA American 13800/2300 V.
6— 1667 KVA Pitts. 13200/2300 V.
3— 200 KVA G. E. 13200/2300 V.
3— 150 KVA Pitts. 11000/2400 V.
3— 100 KVA West. 11000/250-125 V.
3—1250 KVA G. E. 6600/550 V.
3—1000 KVA Pitts. 2300-4600/550 V.
3—1000 KVA Kuhlman 2300/220 V.
3— 667 KVA G. E. 2300-4000Y/500-480-460 V.
4— 150 KVA G. E. 2400-4160/240-120 V.
6— 100 KVA Pitts. 2300/575 V.

PARTIAL LIST—WE HAVE ALL CLASSES OF POWER EQUIPMENT

BREW, WOLTMAN & Co., INC.

50 CHURCH STREET, NEW YORK CITY

Let MacCABE lift your Worries!

230-VDC. CRANE & MILL MOTORS

H.P.	Make	Type	R.P.M.
—2¼	Westinghouse	K-1	
—3½	G.E.	C.O. 2503	975
1—1	P & H	5½ x 3½	850
1—2	Shaw	Class BE	930
1—2½	Reliance	T-224	1600
1—6	Crocker Wheeler	Size ML	930
2—6	G.E.	C.O. 1805	1150
1—7½	Westinghouse	MT 000	650
1—7/10	G.E.	MD 102	100/700
1—10¾	Crocker Wheeler	Size 6K	810
1—10	G.E.	C.O. 2504	700
2—11	Westinghouse	K-5	700
1—19	Crocker Wheeler	Size BW	
1—20	G.E.	C.O. 2504	850
4—30/45	G.E.	MD 104½	
1—50	G.E.	C.O. 1810	725
3—65/85	G.E.	C.O. 1830	700/650
1—85	G.E.	C.O. 1811	550
1—150	Westinghouse	MCB 100	365

GENERAL PURPOSE 230-VDC MOTORS

H.P.	Make	Type	R.P.M.
1— ¾	Crocker Wheeler	Size CM	1400
1— 1	Crocker Wheeler	Size E	1200
2— 2	Allis Chalmers	Size E-50	1750
1— 2	G.E.	RF	500/2000
1— 3	G.E.	C.D. 555	1150
1— 3	G.E.	RLC 111	750/1500
1— 3	Reliance	T-224	3500
1— 3¾	G.E.	RLC 112	600/1800
3— 5	Westinghouse	SK 30	1100
3— 5	Westinghouse	SK 33	1150
3— 5	Westinghouse	SK 40	870
1— 5	Westinghouse	SK 33	1150/1650
1— 5	Reliance	Frame E	500/1800
1— 5	Reliance	Frame F	450/1800
2— 7½	Westinghouse	SK 60	850
1— 7½	Westinghouse	SK 103	400/1600
1— 7½	Westinghouse	SK 40	1150
1— 7½	Reliance	Frame F	450/1800
1— 7½	Reliance	Frame G	275-1650
1— 8	Westinghouse	SK 100L	300/1200
1—10	Westinghouse	SK 50L	1300
1—10	Reliance	Frame G	400/1200
1—15	G.E.	C.D. 75	1750
1—15	Reliance	Frame 230T	300/1200
1—15	Allis Chalmers	Shunt	800
1—15	Crocker Wheeler	CCM	800
2—15	Westinghouse	SK 100L	1100
1—40	Reliance	RH (Compound)	1200
1—70	Reliance		600/1200

(Automatic Control For Many of the Above Motors)

220/440-V-3-PH-60-CY MOTORS

H.P.	Make	Type	R.P.M.
1— 3	G.E.	KT 944	860
1— 3	Wagner	11 VRP	900
1— 5	G.E.	KT 254	1800
1— 5	G.E.	KQ 946	1200
1— 7½	Sprague	MT 181	1800
1— 7½	Wagner	TRW 13	1200
1—10/20	G.E.	KT 522Y	600/1200
1—11	Louis Allis	S. R.	1200
1—11	P&H	Size HW 10 A	820
1—15	Electro Dynamic	FR 1601 Bal	1145
1—20	P&H	Size HW 20	840
1—25	Westinghouse	CS	900
1—35	G.E.	Type I—Form K	1800
2—35	Westinghouse	Type C1	720
2—37	G.E.	ITC 5011-A	700 (25 CY)
1—40	G.E.	ITC 5012	600
1—40	G.E.	KT 444	1800
1—50	G.E.	KT527	1800
1—50	G.E.	KT346	870
1—52	G.E.	ITC 5013	600

SPECIAL: 600-HP. G.E. synchronous motor, 600-RPM. 2300/3/60-cycle.

T. B. MacCABE COMPANY

4306 CLARISSA STREET PHILADELPHIA, PA.

SEARCHLIGHT SECTION

BOILERS

1—813 HP **Edgemoor Boiler**, 200# pressure, Riley underfeed stoker.
2—335 HP **B & W Sectional Header Boilers**, 200# pressure with superheaters, hand fired grates.
2—516 HP **Sterling** 200# pressure boilers, ASME Code, with chain rate stokers.
1—400 HP **Wickes** 3 drum low head boiler, 200# pressure with Chicago Spreader stoker. Installed 1932.
1—90,000# per hr. **Badenhausen** Boiler, 354# pressure.
1—80,000# **Badenhausen Boiler**, 350# pressure with pulverizers and all auxiliaries.
1—1000 HP **Badenhausen Riley** 200# pressure with pulverizer.
1—600 HP **Connelly** 200# pressure.
2—492 HP **Sterling Boilers**, 160# pressure stokers.
1—453 HP **Sterling Boiler** chain rate stoker, 160# pressure.
1—394 HP **Sterling Boiler** chain grate stoker, 160# pressure.
2—250 HP **Sterling Boilers**, 160# pressure equipped with gas burners and controls.
2—253 HP **Sterling Boilers**, 160# pressure with oil burners.
2—250 HP **Wicks Vertical Boilers**, 160# pressure with pulverizers.
2—500 HP **Edge Moor Boilers** 200# pressure.
4—500 HP **Voigt Water Tube Boilers** 175# pressure with chain grate stokers and all auxiliaries.
1—440 HP **B & W Sectional Header Boiler** 150# pressure, underfeed stoker.
1—522 HP **Sterling Boiler** 200# pressure with Firite Stoker.
2—484 HP **Springfield Boilers** 200# pressure.
1—484 HP **Springfield Boiler**, 250# pressure oil burners.
1—520 HP **B&W Sectional Header Boiler**, 200# pressure.
1—**Complete Power Plant** consisting of 2—309 HP **Heine Marine Boilers**, 223# pressure and 2 General Electric Turbines with all auxiliaries.
8—150 HP **Erie City HRT Boilers**, 150# pressure.
1—300 HP **Locomotive Boiler** 150# pressure with all trimmings.
3—250 HP **Erie City** vertical boilers with pulverizers.
1—400 HP **Connelly Boiler** 160# pressure with new tubes and auxiliaries.
2—84" x 20' **HRT Boilers**, 150# pressure all auxiliaries.
2—150 HP **Brownell Boilers**, 125# pressure, rebuilt and guaranteed.
56—50 HP **Vertical Boilers** 150# pressure all auxiliaries.

TURBINES

1—5000 KW **Westinghouse** 1800 RPM 3-60-2300 volts Surface Condenser all auxiliaries.
1—3200 KW **Allis-Chalmers** Condensing **Turbine** with auxiliaries.
1—2500 KW **General Electric Condensing Turbine** with auxiliaries.
1—2500 KW **General Electric Turbine** 400# pressure. Surface condenser.
1—1000 KW **Westinghouse non-condensing turbine** 350# pressure 16# back pres.
1—937 KVA **Allis-Chalmers Turbine.**
1—625 KVA **General Electric Turbine** with jet condenser.
1—2000 KW **Westinghouse Turbine** with Surface Condenser and auxiliaries 3-60-440 volts.
1—300 HP **Kerr Non-condensing** 3600 RPM Turbine.
1—250 KVA **Waite Turbine** either condensing or non-condensing.
1—250 KVA **General Electric non-condensing Turbine.**
1—125 KW **General Electric non-condensing Turbine.**

ENGINE GENERATOR SETS

1—200 KVA **Harrisburg Uniflow Engine Generator Set.**
1—750 KVA **Rice & Sargent** 3-60-600 volt engine generator.
1—480 KW **Rice & Sargent** 3-60-550 volt engine.
1—375 KVA **Chuse Corliss eng. generator.**
1—375 KVA **Chuse vertical Uniflow engine.**
2—312 KVA **Skinner Uniflow engines.**
1—166 KVA **Ames Uniflow engine generator set.**
1—220 KVA **Chuse non-releasing Corliss engine generator.**
1—66" x 125' **steel stack.**
1—48" x 150' **steel stack.**

DIESEL ENGINES

1—300 KVA **Fairbanks-Morse** Full Diesel engine generator set.
1—450 HP **Cooper-Bessemer** Tex rope driven to 300 KW AC Generator.
1—**Complete Diesel Plant** consisting of 1—250 KVA **Buckeye Full Diesel**, 1—225 KVA **Atlas Full Diesel**, 1—94 KVA **Caterpillar Diesel.**
4—500 HP **Busch-Sulzer** 6 cylinder oil engines used only 300 hours.

ENGINE GENERATOR SETS

1—625 KVA **Nordberg** Uniflow engine.
1—1000 KVA **Skinner** Uniflow engine.
1—375 KVA **Skinner** Uniflow engine.

MISCELLANEOUS

2—400 GPM **Centrifugal Boiler Feed Pumps.**
1—2000 HP **Cochrane Metering Feed Water Heater.**
1—10' x 15' **Illinois Forced Draft Chain Grate Stoker.**
1—#8 **Fuller Bonot Pulverizer.**
2—Type AA-6 10 retort **Taylor Underfeed Stokers.**
2—6 Retort **Taylor** Underfeed **Stokers** with fans.

SEE *Fletcher* FIRST!

FLETCHER SALES CO.

325 Fincastle Building — LOUISVILLE, KY.

250 VOLT ROTARY CONVERTERS

1—1500 KW. Westinghouse compound interpole 250 V. D.C., 6 phase, 60 cycle AC Rotary converter, 600 RPM.
3 Single phase, 2300 Volt Transformers 1—DC and 1—AC panel for above.

2—1000 KW., Westinghouse compound interpole 250 volt DC, 6 phase, 60 Cycle AC Rotary Converter 900 RPM.
2—Banks of 3 Single phase, 2300 volt transformers for above and 2—DC and 2—AC panels.

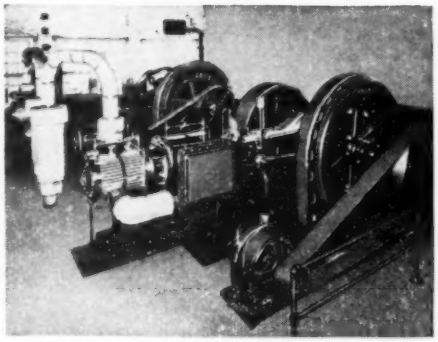
The above in excellent condition.

The above are just a few of the thousand of items we have in Motors, Generators, Turbo Generators, Engine Generators, Motor Generators, Transformers, Circuit Breakers, etc. Please send us your inquiries. What have you for sale?

Keystone Power Plant Equipment Co.
8403 Hegerman Street Philadelphia, Pa.

FOR SALE
1—180 H.P. **Allis-Chalmers**, Horiz. 2-Cylinder 16" x 24" Full Diesel Direct Connected to 156.5 Kva. 3/60/2300-Volt Generator.
1—280 H.P. **De La Vergne**, Horiz., 2-Cylinder 20" x 34" Full Diesel Solid Injection, Direct Connected to 250 Kva G-E Generator 3/60/2300 V. Both have Exciters, and Switch Boards
All Ready for shipment—Kansas City.
Write
W. L. Sullivan, P. O. Box 236, Oklahoma City

ENGINE GENERATOR SETS



1—250 K.V.A. and 1—300 K.V.A. Crocker-Wheeler Generator direct-connected to Skinner Tandem Compound Steam Engine 480 Volts 3 phase, 60 cycles A.C. 200 RPM plus Switch-board instruments. Steam Fixtures include Bends and Separators.

BOILERS

1—444½HP Union Iron Works Company double longitudinal drum water tube Boiler. 200 pound pressure. Equipped with Foster superheater. Diamond soot blowers. 1—S.C. regulator Company water column regulator, brick setting, arranged to burn powdered coal.

WRITE, WIRE OR PHONE

EMSCO EQUIPMENT COMPANY

39 HYATT AVENUE — EMIL A. SCHROTH, OWNER — NEWARK, N. J.
TELEPHONE — MITCHELL 2-3536

1—400 HP Westinghouse, type CW, 3 ph, 60cy, 440V, 450 RPM slip ring motor
1—300 HP Westinghouse, 3 ph, 60cy, 440V CW slip ring motor 495 RPM
3—250 HP General Electric, 3 ph, 60cy, 440V I-17A 400 RPM
1—200 HP Allis Chalmers, 3-60-440V, 514 RPM
2—150 HP Allis-Chalmers, 3 ph, 60cy, 440V, 450 RPM slip ring
1—150 HP General Electric type KT, fr. 558 3-60-2200V 880 RPM
1—150 HP General Electric, type ATI, 3 ph, 60cy, 440V 900 RPM, 0.8 PF syn. motor
1—150 HP Electric Mach. syn. motor 125 KVA, 3-60-220V, 1200 RPM
1—150 HP General Electric, 3-60-440V 1-17A 360 RPM slip ring
1—150 HP Westinghouse, 2 ph, 60cy, 440V frame 1000, CW, 390 RPM slip ring
2—125 HP Westinghouse CS774C 3-60-440V 860 RPM Ball bearing.
4—100 HP General Electric, 3-60-440V 495 RPM, MT562 slip ring
1—100 HP General Electric type I, form K, 3-60-220V 575 RPM
1—100 HP Westinghouse, type CCL, 3 ph, 60 cy, 2200V, 1750 RPM, Squirrel Cage
1—100 HP Allis-Chalmers, type ANY, 3 ph, 60 cy, 220V, 690 RPM slip ring

2—75 H.P., 300-foot head Pumps: 2200V Fairbanks-Morse, 1800 RPM 3ph 60cy slip ring motors direct connected to 500 GPM 3 stage

1—75 HP Allis-Chalmers, 3 ph, 60 cy, 440V, 450 RPM slip ring
1—75 HP Westinghouse, type CW, 3 ph, 60 cy, 440V, 720 RPM slip ring, 3 or 2 bearings
1—75 HP General Electric, type MT, frame 558, 3 ph, 60 cy, 440V, 575 RPM
1—75 HP Fairbanks-Morse, type H, frame 165C, 3 ph, 60 cy, 550V, 900 RPM Squirrel Cage
1—75 HP Lincoln, type IQ, 2 ph, 60 cy, 440V, 600 RPM Squirrel Cage
1—75 HP Reliance, 3 ph, 60 cy, 440V, 720 RPM totally enclosed fan cooled
1—75 HP Allis-Chalmers, 3 ph, 60 cy, 440V, 600 RPM slip ring
1—75 HP General Electric 3 ph, 60 cy, 440V, 600 RPM, MT558 slip ring
1—75 HP Western Elec. type I, 3-60-440V, 690 RPM
1—75 HP General Electric, 3-60-440V, type I, 575 RPM
3—25/65 HP Westinghouse, frame 762C, 3-60-440V, 600/1200 RPM, 2 speed slip ring motor
1—60 HP General Electric type KT, frame 346, 3 ph, 60 cy, 440V, 870 RPM
1—60 HP Lincoln 3-60-220V frame IXM, Sq. Cage 900 RPM
1—60 HP, General Electric, 3-60-440V, 720 RPM, type I form K
1—60 HP General Electric 3-60-440V, 1750 RPM, type I slip ring
1—60 HP General Electric 3-60-440V, KT542, 870 RPM Sq. Cage
1—50 HP General Electric 3-60-440V, 3450 RPM, KT527 tot. encl. fan colled
1—50 HP Wagner (Fynn Weichsel) 3-60-440V, 1200 RPM
1—50 HP General Electric 3-60-220V, 1150 RPM, type I, slip ring
1—50 HP Triumph 3-60-440V, type C12, 1150 RPM, slip ring, rotor & stator re-wound
1—50 HP General Electric, 3-60-440V, KT 346, 870 RPM, Sq. Cage
1—50 HP General Electric 3-60-440V, 900 RPM, type I-M, slip ring
1—50 HP Howell 3-60-440V, 870 RPM, type SCBB ball bearing Sq. cage
1—50 HP General Electric 3-60-440V, 720 RPM, type I-K, Sq. Cage
2—50 HP Allis-Chalmers 3-60-440V, 690 RPM slip ring
1—50 HP General Electric 3-60-440V, 690 RPM, MTS 46, slip ring
1—50 HP Ideal 3-60-440V, 580 RPM, type AV, slip ring
3—50 HP General Electric 3-60-440V, 575 RPM, type I-K, fr. 13A, Sq. Cage
1—50 HP Wagner 3-60-440V, 495 RPM, type BM, Sq. Cage
1—50 HP Allis-Chalmers 3-60-440V, 490 RPM, Sq. Cage
1—50 HP General Electric 3-60-440V, 490 RPM, type I-M, slip ring
1—50 HP Westinghouse CS 2-60-440V, 420 RPM, Sq. Cage

We have a stock of 3000 motors from 1 HP to 50 HP in AC and DC. We have a very large stock of air circuit breakers up to 12000 amp.

1—100 HP General Electric, type CD, fr. 123, 230V, 1200 RPM
1—100 HP General Electric, type RF 17, 230V, 400/1200 RPM
1—100 HP Westinghouse type SK, frame 140, 230V, 1700 RPM
1—75 HP General Electric, type CD, fr. 176, 550V, 250/1000 RPM (planer)
1—60 HP Westinghouse, type SK, frame 160, 230V, 680 RPM
1—60 HP Westinghouse type SK140L, 115V, 1150 RPM vertical
1—50 HP Westinghouse, type SK, fr. 160, 230V, 565 RPM
1—50 General Electric, class 5, Form B, 600V, 600 RPM
1—50 HP Westinghouse SK200, 245 RPM, 230V

1—DC Generator 45KW Bullock 120V 375A 900 RPM

2—40 HP C & C 230V, 250/1000 (planer)

25 CYCLE MOTORS

1—50 HP Westinghouse 3-25cy-440V, 720 RPM, type MS, Sq. Cage
1—50 HP General Electric, 3-25cy-440V, 700 RPM, type I-M, slip ring
1—40 HP Westinghouse 3-25cy-440V, 1450 RPM, type CS, Sq. Cage
1—40 HP Westinghouse 3-25cy-440V, 730 RPM, type CI, frame 753A slip ring crane
1—35 HP Allis-Chalmers 3-25cy-440V, 720 RPM, slip ring
1—30 HP General Electric 3-25cy-440V, 1450 RPM, FT 527, vertical B.B.
1—30 HP Westinghouse 3-25cy-440V, 720 RPM, CS, Sq. Cage

The Wente Electric Co.,

Hamilton, Ohio

REBUILT MOTORS & GENERATORS SINCE 1906

SYNCHRONOUS CONVERTERS

500 KW AL-CH. 250 D.C. 2300/4000 A.C. 1200 RPM
500 KW WEST. 250 D.C. 2300/4000 A.C. 1200 RPM
300 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM
200 KW AL-CH. 250 D.C. 2300/4000 A.C. 1200 RPM
150 KW G.E. 250 D.C. 2300/4000 A.C. 1200 RPM
150 KW WEST. 250 D.C. 2300/4000 A.C. 1200 RPM

MOTOR GENERATORS

200 KW G.E. SYN. 250 V. 2300/4000 A.C. 1200 RPM
200 KW G.E. IND. 600 V. 2300 A.C. 1200 RPM
200 KW R.W. SYN. 250 V. 2300/4000 A.C. 900 RPM

Each unit listed above is owned by us and is available now for immediate purchase.

WALLACE E. KIRK CO.

Incorporated

502 Grant Building Pittsburgh, Pa.

WE SELL — PURCHASE — RENT

Power & Dist. Transf. from one to 5000 KVA. Any Volt or Frequency.

Motors, Generators, Turbines, Centrifugal Pumps, etc.

A.C. & D.C. Elec'l Meters. Potential & Current Transf. All Makes. Scales Calibrated to your requirements.

Catalog & Prices on Request

PHILADELPHIA TRANSFORMER COMPANY

2829 Cedar St. Phila. Pa.

PIPE
CUT TO SKETCH ⅛" to 24"
METROPOLITAN
PLUMBING SUPPLY CO., INC.
INDUSTRIAL AND MARINE SUPPLIES
Large SURPLUS STOCK
STEEL--WROUGHT IRON--CAST IRON
BRASS-COPPER-CEMENT LINED PIPE
Power Plant Valves & Engineering Specialties - Jenkins - Fairbanks & Sarco Valves
313 EAST 31st STREET, N.Y.C.
HOURLY NATION-WIDE SHIPMENTS
Phone MU rray Hill 3-3408
FLANGED VALVES & FITTINGS

SAMPLE OFFERINGS

2000 KW 440 volt 180# Turbo Gen. Rebuilt.
1250 KW Westinghouse 3600 rpm Turbine end.
360 HP 300 KVA Fairbanks Diesel Generator.
150 HP St. Mary's Diesel Engine, 4 cyl. horiz.
150 HP Fairbanks Morse "Y" Oil Engine.
562 ft. Chic. Pneu. 100 HP motor driven Comp.
1574 ft. Sullivan WN-31 Synchronous Motor Driven Compressor 3-60-2300 v. 100 or 150 lb.
75, 125, 200 KVA 257 rpm Alternators Clutch pulley for 360 HP Fairbanks Diesel.

MISSISSIPPI VALLEY EQUIPMENT CO.

507 Locust St. St. Louis, Mo.

Have you anything for Sale?

DIESEL ENGINES

Large selection—All sizes and types. Generator units, marine engines, gasoline engines, auxiliaries —also boilers, steam engines, turbo generators.

Complete information on request.

A. G. SCHOONMAKER COMPANY

50 Church St. Phone—Worth 2-0455 New York, N.Y.

POWER EQUIPMENT FOR PROMPT SHIPMENT

SQUIRREL CAGE MOTORS (3 ph. 60 cy.)

HP	Make	Volts	Speed	Type
700	G.E.	6600	1800	
150	West.	220/440	580	CCL
125/40	Cr. Wh.	2200	700	125AQ
125	Burke	220/440	1200	
125	Cr. Wh.	2200	700	125AQ

DC SERIES & CPD. MOTORS

HP	Make	Type	Speed
2	R & M	122	1000
5	R & M	125	1000
15	West.		650
25	Shaw		600
50	Shaw		600
100	G. E.	MD 108	480
130	G. E.	CO 1812	550
175	G. E.	MDS 1901	475
200	Allis	Interpole	600

SYN. MOTORS, 3 ph. 60 cy.

HP	Make	Volts	Speed
75 (2)	G. E. ATI	2200	900

SLIP RING MOTORS, (3 ph. 60 cy.)

HP	Make	Volts	Speed	Type
1000	Al. Ch.	440	235	
700	G. E.	2200	393	MT 432
300	G. E.	440	600	I-M
200	G. E.	2200	240	MT 412
150	G. E.	220/440	720	I-M
150	Al. Ch.	2200	685	
150	G. E.	220	575	I-M
125	Al. Ch.	2200	435	
100	Al. Ch.	220/440	575	
100	G. E.-25 cy.	220/440	500	MI-108

"Wound Rotor Motors" (3 ph. 60 cy.)

HP	Make	Volts	Speed	Type
200	G. E.	2200	600	I-L
150	G. E.	2200	600	I-I.

TRANSFORMERS

Qu.	KVA	Make	Voltage
3	37	West.	4400/185
3	50	G. E.	22000/2200
3	75	G. E.	2300/110/220
3	100	Uptegraff	440/220
1	150	G. E. (3 ph.)	2080/230/460

OIL ENGINE DRIVE AIR COMPRESSORS

Chicago Pneumatic simplate valve type, N503 straight line 16½ & 11 x 18" capacity 492 cu. ft. displacement, 100# pressure, with air receiver and starting air compressor.
2—14x10" Sullivan 505 cu.ft. compressors
1—10x12 Ch. Pneu. 164 cu. ft. steam compressor

M-G SETS 3 ph. 60 cy. (Syn)

150 KW West. 550 v. DC—2200 AC 1200 RPM
150 KW Ridg. 250 v. DC—2300/3/60 AC
65 KW G.E. 250 v. 1200 RPM—100 HP 220/440 v. AC

ELECTRIC LOCOMOTIVES

4—6 Ton G. E. Storage Battery Loco. 44" Ga. with Batteries (Can change to 36" Ga.)
2—5 Ton West. 250 v. 36" Ga. with Gathering reels.

SCREENS

2—4' x 5' Tyler Hummer Screens with Vibrators.

In addition to the above, we have hundreds of other items in stock—kindly send us your inquiries.

MOORHEAD-REITMEYER CO., INC.

Pittsburgh, Pennsylvania

IF YOU DON'T KNOW MACHINERY—KNOW YOUR MACHINERY DEALER

HIGH PRESSURE BOILERS

"New and Used Not Abused"

4—500 H.P. 200 lb. Vogt W.T. Boilers with stokers

3—516 H.P. 200 lb. B. & W. Sterling Boilers with stokers

2—72 x 18 150 lb. H.R.T. Boilers with Dutch ovens

2—72 x 18 150 lb. pressure H.R.T. Boilers with stokers, built in 1929

5 sets 2½" 200 lb. blow off Yarway valves complete. Also full open bottom mud-ring boilers, 250 to 350 lb. pressure All A.S.M.E. Code

JOE SULLIVAN CO.
523 N. Hamlin Ave. Chicago, Ill.
Phone Van Buren 8669

COAL PULVERIZING PLANT

3—Steel Coal Bins, approximately 50 cu. yds. each

1—Raymond 5 Roll High Side Mill, capacity 4 tons coal per hour, 90% thru 200 mesh

1—Hardinge 7' x 36" Ball Mill, with air classifier

1—Ruggles Cole A-4 Coal Dryer

4—Bucket Elevators, 40' to 50' centers

Individually priced for quick sale, f.o.b. cars Buffalo, N. Y.

WIRE • PHONE • WRITE

BRILL Equipment Co
183 VARICK STREET NEW YORK

---

250 KW 125 V. 320 RPM with 4 cyl. 11 x 12 vertical uniflow steam engine, equal to new unit.
NEW 400 H.P. 4 cyl. 11 x 10 Vertical Uniflow steam engine bare unit. Supply any generator.
50 KW GE 125/250 V. Marine Set.
200 K. W. 125 V. or 250 V. Skinner Uniflow engine.
750 K.W. 250 V. 720 R.P.M. interpole generator.
740 KW 250 V. Induction bleeder turbo set, geared.
Boilers of all sizes, stokers, oil burners.
Turbine Sets, A.C. and D.C. to 1000 K.W.
Diesels of all sizes, large and small.

Send your lists of equipment

JAMES K. HOOPER
50 CHURCH ST. NEW YORK

COMPLETE POWER PLANTS

TURBO-GENERATORS—CONDENSING

1—7500 KW G. E. Co., 60-3-5000 V
2—5000 KW G. E. Co., 60-3-2300 V
1—5000 KW Westinghouse, 60-3-2300 V
1—4000 KW G. E. Co., 60-3-2300, 4000 V
1—3200 KW Allis-Chal., 60-3-2300, 4000
1—2500 KW G. E. Co., 60-3-2400, 4000
1—2500 KW G. E. Co., 60-3-2300
1—2000 KW Westinghouse, 60-3-480 V
1—2000 KW G. E. Co., 60-3-600 V.
1—2000 KW G. E. Co., 60-3-2300 V
1—1500 KW Westinghouse, 60-3-2300
1—1250 KW G. E. Co., 60-3-2300
3—1000 KW G. E. Co., 60-3-2300
2— 750 KW G. E. Co., 60-3-2300
2— 520 KW G. E. Co., 60-3-2300
Also 1—200 and 1—300 KW Tubes.

TURBO-GENERATORS NON-CONDENSING

1—2000 KW G. E. Co., 60-3-480
1—1200 KW Terry, 60-3-480
2—1000 KW G. E. Co., 60-3-480
1—1000 KW Allis Ch., 60-3-2300
1— 750 KW Westinghouse, 60-3-480 350# 100# EXHAUST
1— 750 KW Westinghouse, 60-3-2300
Also some smaller units

BOILERS

1—1250 HP Keeler, 175#
1—1000 HP B & W 200#
4—1000 HP Heine 250#
4— 750 HP Edgmoor 200#
2— 500 HP Edgmoor 150#
4— 620 HP Badenhausen 160#
Smaller boilers on application.
Surface Cond. 3600 sq. ft. to 12000 sq. ft.

CHARLES B. REARICK **30 Church St., New York**

1—Westinghouse CS, 500 HP, 450 rpm, AC motor. Needs rewinding. Will rewind to any speed and voltage within capacity of frame.
1—G. E. slip ring motor, 1-15A, 125 HP, 600 rpm, 440-3-60, rebuilt.
3—G. E. Transformers, 37½ KVA, 22000/115-230 volt, 1 ph, 60 cy.
1—400 amp. DC welding M-G set, 440-3-60 supply voltage.

SEND US YOUR INQUIRIES
JACKSON BAYLEY ELECTRIC COMPANY
CANTON, OHIO

FOR SALE

2—210 H.P. Bessemer Full Diesel Engines. Solid Injection, 6 Cylinder, 4 Cycle, 325 R.P.M., Bore 11" x 14" Stroke, Type J.R.S.

ALJON ELECTRIC DIESEL COMPANY
151-55 Washington Street Brooklyn, N. Y.
Main 4-3804-5

PUSH BUTTON CONTROLS

300—C-H Bulletin No. 10250 two button, heavy duty push buttons. New—specially priced. Lots of 5—$6.50 each.

Water tight and dust tight, two-speed controls from 1 to 30 H.P.

REVERSING MAGNETICS

300—C-H Reversing Magnets, size 00, Bulletin No. 9595, 220v, 3ph, 60cy, New. Write for prices.

GEAR REDUCERS

20—D. O. James 5 H.P. Speed Reducers. 900 to 25.7 R.P.M. Excellent condition.
2—Marley Co., 15 H.P. Speed Reducers. 1150 to 334 R.P.M. Timken Bearings. New.

ELECTRIC EQUIPMENT

Large stock of assorted Electrical Equipment. Write listing your needs or offering your surplus electrical equipment.

ELECTRIC MOTOR & MACHINERY CO.
1132 MT. HOPE ROCHESTER (7) N. Y.

SLIP RING MOTORS, 3 PH., 60-CY.

HP	Volts	Make	Speed
700	2200	G.E.	900
400 (2)	400	Whse.	514
350	220-440	G.E.	1800
350	2200	G.E.	600
300	2300-4000	G.E.	1200
250	440-550	G.E.	600
200	2200-550	G.E.	1800
200	2200-400	G.E.	600
150	440-220	G.E.	1800
150	2200	G.E.	900
150	2200-440	Whse.	1800
150	550-2200	G.E.	1800
125	440-220	G.E.	600
100	550-2200	G.E.	720
100	440-220	G.E.	1800
100	220-440	G.E.	720
100	220-440	G.E.	900
75	220-440	G.E.	600

SYNCHRONOUS MOTORS, 3-PH., 60-CY.

600	2200	Whse.	900
400	440-220	Whse.	276
350	440-220	G.E.	900
240	2300-440-220	G.E.	600
200	2300-4000	G.E.	1200
150	2200	G.E.	1800
100	440-220	G.E.	1200

PUMP

1—8" Dredge Pump 1880 GPM, 120' Morris Machine Works with direct connected Slip Ring Motor 125 HP, 600 RPM, G.E.

AIR COMPRESSOR

1—465 CFM Ing. Rand Motor Driven Air Compressor Unit Type XRB 8" x 13" x 10" 300 RPM—100# Gu. No. 89242-3 driven by 75 HP GE AC Motor complete all Accessories including Receiver.

TRANSFORMERS—60 CYCLE

3—667 kva., G.E., 2300/4000-460/480 Volts.
3—667 kva., Whse. 22000-2300.
3—500 kva., Whse. 22000-2300.
3—350 kva., G.E., type H-KD 13200-2300.
3—333 kva., G.E., type H-KDD 2400-460/230.
3—250 kva., Whse. 13,800-460.
3—200 kva., G.E., type H 10000-600.
3—200 kva., G.E., H-KD 6600-2300/4000Y., 25 cy.
3—175 kva., G.E., 4000-480.
3—150 kva., G.E., type H-KDD 13200-2300.
3—150 kva., Al. Chal., type OISC 10400-2400.
1—100 kva., Pittsburgh, type OISC 2400-240-120.
3—100 kva., G.E., type H 2400-240/480.
3—100 kva., G.E., type H-KDD, 6900/11950Y-230/115.
3—100 kva., Whse. 22,000-2300.
2— 75 kva., G.E., type HK, 2300-230/115.
3— 50 kva., Moloney, 2300-230/115.
6— 50 kva., Whse. type SK, 13800-240/120.
3— 50 kva., Whse. 22,000-2300.

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
500	440/220	G.E.	IK	1200
500	440/220	G.E.	IK	900
400	2200	Whse.	C.S.	1800
300	2200	G.E.	IE-K	1800
250	2200	G.E.	IK	600
200	220/440	G.E.	IK	720
150	2200	Allis. Ch.	AN	450
100	2200	G.E.	IK	600
100	2200	G.E.	IE-K	1800
100	550	G.E.	KT	900
100	220/440	G.E.	KT	720
75	2200	G.E.	KT	900
75	2300	G.E.	IE-K	1800
50	220/440	G.E.	K	1800

MOTOR GENERATOR SETS

75 KW, 125 V, 1200 RPM Westinghouse Conn. to 112 H.P. 2300/440 V, 3 ph, 60 cy. Ind. motor.
1—75 KW 125 V. 1200 RPM, GE Conn to 100 HP 440 V. 3 ph. 60 cy. Ind. motor.
1—75 KW, 250 V, 1800 RPM, Cr. Wh., Type CCD con. to 100 H.P., 2200 V., 3 ph., 60 cy.
1—250 KW Motor Generator Set, very modern, practically new, see further description under that heading.

A.C. GENERATORS

1—500 kva., 900 r.p.m., 2209 V. Whse. Condenser.
1—300 kva., 900 r.p.m., 240/480 V., G.E.
1—225 kva., 600 r.p.m., 2200-240 V., G.E.
1—187 kva., 900 r.p.m., 2200-550 V., Westghse.

STEPHEN HALL & CO.

HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

NEW AND REBUILT GENERATORS

2—New Kohler 1½ KVA, AC, 1500 watt, gas driven engine 120 volts, single phase, lighting generators.
1—New Kohler, 10 KVA, 120 volts single phase, 60 cycle, gas engine driven generator sets.
2—New Lister-Blackstone "Nighthawk" Portable 5 KW 120 volts, AC, generator Sets, complete with four 1000 watt reflectors mtd on 8' telescopic extensions mtd on two wheel spring mtd trailer.
1—New Kohler, 5 KVA, 120 Volts, gas engine driven Generator.
2—New Universal 5 KVA, 120 Volts, gas engine driven generators.
1—Rebuilt 20 KW, 125 volts, Fairbanks-Morse Diesel Generator.
2—Rebuilt 15 KW, 110 volts, Allis-Chalmers gas eng. driven Gen.
1—Rebuilt 50 KVA Superior diesel eng. driven Gen., V-belt drive 220 volts, 3 phase, 60 cycle, AC Generator, .8 power factor, powered with Superior 100 H.P. 6 cylinder diesel engine.
1—Rebuilt 18.7 KVA Superior diesel engine driven Generator, direct connected, powered with 2 cyl. eng., 1200 r.p.m. and Columbia Generator, 220 volts, 3 phase, 60 cycle, .8 power factor. Machine in excellent condition.
1—Rebuilt Buda 15 Kw gas engine driven Generator Set, 110 volts DC.
1—Rebuilt 7½ KW Winton gas eng. driven, 110 volt, DC Gen. Set.

CHICAGO CONSTRUCTION EQUIPMENT CO.
13912 SOUTH HALSTED ST. • CHICAGO, ILL.
PHONE RIVERDALE 1300

STEAM PUMPING ENGINES

1—**Snow** 6 mgd. C&FW Cr. Com. Opp. Type Cond. 20-40x14¾x36, with waterwork type cond.
1—**Allis-Chal.** 4 mgd. cr. com. cond. size 12x28x13x24. Fine cond.

PUMP VALVES

Birch Valves for reciprocating pumps.

LARGE GATE VALVES

4—48" **Chapman** Motor operated solid wedge gate valves non-rising stem.
1—20" **Rensselaer** #13 Iron Body Bronze Mounted Hub End Gate Valve with 16" Iron Brass Lined Hydl. Cyl. with indicating Rod & Eyebolt, 100#
1—20" **Crane** 125# Flanged Hand Wheel operating Gate Valve.

SURFACE CONDENSER

1—10 AD 4 pass 210 ft. **Foster Wheeler** over Comb. Air Circulating and Tail Pump.

BIRCH MANUFACTURING COMPANY
1523 Sedgwick St. Chicago, Ill.

Motor Generator Sets—Synchronous Motors, etc.

MOTOR GENERATOR SETS & ROTARIES 3 phase, 60 cycle, A.C.

1—West. 200 KW, 125/250 volt, 1200 RPM rotary
1—G.E. 250 KW, 275 volt, 1200 RPM rotary
1—Ridgway 100 KW 250 V. M.G. set 2300 A.C.

VERTICAL MOTORS

1—G. E. 50 HP 1200 RPM 3 ph 60 cy 220 V.
1—Reliance Fan-cooled 25 HP 1750 RPM 220/440 V.

SYNCHRONOUS MOTORS 3 phase, 60 cycle, A.C.

1—Burke 300 HP 900 RPM 440/220 Volt
1—Ideal 50 HP 600 RPM 2300 Volt

SLIP RING MOTORS, 3 phase, 60 cycle

Allis-Chalmers 250 HP 600 RPM 440 Volt
G. E. 60 HP 600 RPM 440 Volt
G. E. 62½ HP 1150 RPM 440/220 Volt

SQUIRREL CAGE MOTORS 3 phase, 60 cycle, 220/1440 Volts

1—150 HP 1750 RPM Allis-Chalmers
2—100 HP 550 RPM Westinghouse MS
1— 75 HP 575 RPM Westinghouse CS—368-A
1— 75 HP 600 RPM Fairbanks-Morse
1— 75 HP 720 RPM Lincoln I-P
1— 65 HP 860 RPM Allis-Chalmers
1— 50 HP 690 RPM Westinghouse CS—758
1— 50 HP 875 RPM Westinghouse CS
1— 50 HP 865 RPM Ideal
4— 20 HP 870 RPM West. T.E.F.C. CS—W-405
2— 20 HP 870 RPM West. CS—W-405
2— 15 HP 860 RPM Allis-Chalmers

ALTERNATOR SPECIAL, Allis-Chalmers, 125 KVA, 277 RPM, 3 phase, 60 cycle

The Electric Motor & Repair Co., Cuyahoga Falls, O.

BOILERS

NEW and USED!

All makes & sizes for prompt shipment

2—500 H.P. Stirling 160#
1—312 H.P. Stirling 160#
3—300 H.P. B. & W. 150#
1—200 H.P. Heine 160#
1—516 H.P. Stirling 200#

We want to buy 50 HRT boilers from 100 to 200 H.P. 125# pressure or better.

J. F. DAVIS CO.
122 S. Michigan Ave. CHICAGO

120 KW ENGINE GENERATOR SET

1—120 KW G.E. Co. Type TRE Generator, 3/60/2300 volts, direct connected to 125# Harrisburg Fleming Steam Engine.

HOIST

1—50 HP Lidgerwood Double Drum Hoist, 24x24" drums, side by side, with or without AC or DC motor.

DEEP WELL PUMPS

2—600 GPM, 116 ft. head, Kingsford, size #4 Deep Well Pumps with 40 HP G. E. Co. Type CD-93, 230 V. DC vertical motors.

CRUSHERS

2 Size 36" x 48" Link Belt Double Roll Coal Crushers, product size, 1½" to 3", spring relief type.

ELECTRIC EQUIPMENT FOR INDUSTRY

LET US KNOW YOUR REQUIREMENTS

REBUILT & GUARANTEED STOCK
MOTORS, D.C. & A.C. TRANSFORMERS
MOTOR GENERATOR SETS
ROTARY CONVERTERS
SWITCHBOARDS BUILT TO ORDER

SYNCHRONOUS MOTORS

2—150 HP W.E. Co. Type G, 80% P.F. for 3/60/220-440 volts, 1200 RPM, with direct connected exciters.
2—250 HP W. E. Co. Type HR, 100% P.F. for 3/60/2300 volts, Engine Type, one (1) at 240 RPM, one (1) at 277 RPM.

100 KW ROTARY CONVERTER

1—100 KW G.E. Co. Type TCC for 250 V—DC and 3/60/2300 V—AC, Transformer and Switchgear, 1200 RPM.

CENTRIFUGAL PUMPS

2—2700 GPM, 170 ft. head Lecourtnay Centrifugal Pumps driven by 150 HP W.E. Co. Type G, 80% P.F. Synch. motors 3/60/220-440 volts, 1200 RPM.

PLATFORM SCALE

1—15 ton Fairbanks Industrial Platform Scale, 5' x 8'.

FREQUENCY CHANGERS — TURBO GENERATORS — AC & DC MANUAL MAGNETIC CONTROL — CENTRIFUGAL PUMPS — AC & DC SWITCHBOARDS

FOR DETAILS, WRITE **JOHN D. CRAWBUCK CO.** *714-15 EMPIRE BLDG. PITTSBURGH, PENN.*

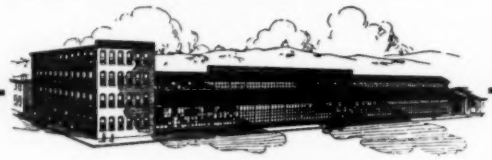
SEARCHLIGHT SECTION

USED WATER TOWERS and TANKS

Bought & Sold

20,000 to 250,000 gal. capacity; oil storage, pressure, steel, wooden and glass-lined tanks; boilers, sprinkler systems, pumps and piping.

EVEREADY ELECTRIC & SUPPLY CO.
Bridgeport, Conn.
E. J. McCallum, Jr., Pres.



AT YOUR SERVICE

120,000 SQ. FT. OF WAREHOUSE SPACE . .

. . . Housing our Complete Rebuilding Facilities . . . Also a wide range of Electric Motors and Power Plant Equipment

TODAY'S DEMAND FOR RECONDITIONED EQUIPMENT OBSOLETES OUR STOCK LISTING BEFORE IT CAN BE PRINTED

Write your requirements for

MOTORS
GENERATORS
MOTOR-GENERATOR SETS
ENGINE-GENERATOR UNITS

THE GLOW ELECTRIC CO.

933-943 HARRIET ST. Phone MA. 3024 CINCINNATI, OHIO

PRESSURE TANKS

7 54" diameter by 18' A.S.M.E. 200 pounds pressure. Prompt delivery.

M. J. HUNT'S SONS
1600 North Delaware Avenue
Philadelphia, Pennsylvania

VALVES

INDUSTRIAL & MARINE

METROPOLITAN PLUMBING SUPPLY CO., INC.

Power Plant Valves and Engineering Specialties for Oil, Steam, Gas, Air, Liquids and Chemicals.
Jenkins, Fairbanks, Sarco, Powell Valves and surplus.
Large Complete Stocks ⅛" to 24"
313 EAST 31st ST., NEW YORK CITY
For Hourly Nation-wide Shipments
CALL MUrray Hill 3-3408

CRANE PIPE & FITTINGS

1—7500 KW. 5000 v. 60 Cy. 3 Ph. TURBO with Surface Condenser
1—4000 KW. TURBO 4150 v. 60 Cy. 3 Ph. with Cond.
1—3000 KW. TURBO 60 Cy. 3 Ph. 480 v. with Cond.
HEAT EXCHANGER 606 tubes 1¼" x 9'6"
1500 CFM 2 STAGE AIR COMP. 275 Hp.
2200 v. 60 Cy. 3 Ph. Syn. Motor Dr.
3—100 KW. 125-250 V. DC. G.E. TURBOS

1—New FAN 66750 CFM 2" to 6" Pres.
4—CENT. PUMPS 4166 GPM. 162' Head with 440 v. 60 Cy. 3 Ph. AC. Motors
1—36000 GPM, 27' head CENT. PUMPS
400, 700, 1500, and 2500 HP. A.C. Motors
TRAVELING CRANE 75 ton Case, 64' span, 3 motors. Also others.
750 KW. and 110 KW. AC HYDRO ELEC. PLANTS and others
3—559 Hp. 200# BOILERS with stokers

ROSS POWER EQUIPMENT CO., Indianapolis, Ind.

AC. DIESEL ENGINE SETS

1—30 HP. 20 KW. 240 v. 400 RPM.
1—90 HP. 50 KW. 240 v. 400 RPM.
2—80 HP. 44 KW. 240 v. 900 RPM.
1—360 HP. 240 KW. 2300 v. 257 RPM.
2—450 HP. 300 KW. 440 v. 360 RPM. also others AC & DC.
3—600 ft. Diesel Compressors Boilers & Turbo Generators.

STEPHEN A. DOUGLASS CO.
630 Fort Washington Ave., New York, N. Y.

FOR SALE

3000 KW 3750 KVA General Electric 3 phase, 60 cycle, 480 v., 150# Condensing, 3600 RPM Steam Turbo Generator with complete Powerhouse Auxiliaries. Surface Condenser, Exciters, Evactors, Condensate Pumps, Switchboard, Regulator, 10 Distribution Panels, 60 enclosed Safety Switch Panel Circuits, 20-ton Bridge Crane, Circulating Pumps, Air Coolers, Piping, etc. Also 1050 HP Sterling type 260# Boiler.

Sundfelt Equipment Company
3422 First Ave. So., Seattle, Wash.

FIRE TUBE BOILERS

(NEW OR USED)

ONE WEEK'S DELIVERY AFTER RECEIPT OF ORDER

Sizes from 50 H.P. to 125 H.P., 50# W.P. to 350# W.P., Oil, Gas or Coal Fired, Shaker Grates or Stokers, Hartford or Oklahoma approved Certificate.

MOORE & COMPANY
1701 Nat'l Bank of Tulsa Bldg.
Tulsa, Oklahoma
TELEPHONE 2-0058

SLIP RING MOTORS
40 HP. 1800 RPM. 3/60/440, Fair. Morse BB
40 HP. 1200 RPM 3/60/2200, Gen. Elec. MT
40 HP. 900 RPM. 3/60/220, West'house CW
40 HP. 600 RPM. 3/60/440, Gen. Elec. IM
75 HP. 900 RPM. 3/60/220, Gen. Elec. MT
150 HP. 900 RPM. 3/60/440, Gen. Elec. Vert.

AC GENERATORS
150 KW. 600 RPM. 3/60/220, Gen. Elec. ATB
150 KW. 225 RPM. 3/60/2300, Ft. Wayne
200 KW. 720 RPM. 3/60/240, Gen. Elec. ATB

DC GENERATORS
35 KW. 115 volt, 720 RPM. Allis Chalmers
75 KW. 250 volt, 500 RPM. Northern

AIR COMPRESSOR
14 & 9 x 12 Ingersoll-Rand Imperial type 10 2 stage complete 100 HP. syn. motor

ROCKFORD ELECTRIC EQUIPMENT CO.
721 South Wyman St., Rockford, Illinois

SPECIALS

1—Steel Bldg. & 7½ Ton OET Crane
1—75 Ton, 65' Span, OET Crane
1—120 HP F-M Full Diesel
1—500 HP ASME, 200# WT Boiler
2—350 HP, 185#, WT Boilers
1—80 KW AC Gen. D/C 4-Valve Eng.

H. & P. MACHINERY CO. 6719 Etzel Ave., St. Louis, Mo.

Reconditioned Motors, Generators, Control Equipment, etc.
Send for 32 page stock list.
Electric Apparatus Repair Company
Specialists on Rebuilding Motors, Generators and Controls
1410 No. 6th St., PHILA., PA.

DIESEL ENGINES AND GENERATOR SETS

1—20 HP Fairbanks Morse	1—100 HP Fairbanks Morse	1—210 HP Superior
1—25 HP Fairbanks Morse	1—112½ HP Buckeye	1—225 HP Buckeye
1—55 HP Ingersoll Rand	2—120 HP Hercules*	1—360 HP Fairbanks Morse
1—80 HP Atlas Imperial	1—200 HP Buda*	1—440 HP Ingersoll Rand

*Fitted With Clutch and Power Take-Off

A. G. SCHOONMAKER COMPANY
50 Church Street (Dept. Eng.) Phone—Worth 2-0455-6-7 New York, N. Y.

POWER PLANT EQUIPMENT

TURBO GENERATORS

5000 KW GE Cond. 2300 volts
2500 KW GE Cond. 2300 volts
2000 KW GE Cond. 600 volts
600 KW GE Cond. 600 volts
500 KW GE Extract, 600 volts
200 KW GE Cond. 2300 volts
150 KW West Non-Cond. 600 volts

TURBINES ONLY

230 HP Terry—150 lbs.
210 HP Terry—250 lbs.
175 HP GE—110 lbs.

AIR COMPRESSORS

5600 CuFt IR 35# Motor Driven
600 CuFt IR 500# Steam Driven
275 CuFt IR 110# Steam Driven
146 CuFt IR 1200# Belted
136 CuFt Chic. 110# Belted

CENTRIFUGAL COMPRESSOR

10,000 CuFt—35# Turbine Driven
7,000 CuFt 21.7# Turbine Driven

BOILERS

1—750 HP Heine—200# Stoker
5—318 HP Manning Type—190#
2—303 HP Sterling—160#
2—255 HP H.R.T. 150# Stoker
2—235 HP H.R.T. 175# Grates
2—200 HP H.R.T. 100# Grates
2—100 HP H.R.T. 125# Grates
1—400 HP Sterling 160# Stoker

CRANES

1—15 Ton 35' Span Hand Operated
1—25 Ton 53' Span Hand Operated

Also transformers, engines and cranes

Send us your inquiries

A. LEE ELLIS CO., U. S. Mchy. Bldg., Boston, Mass.

The Buyer Must Be Satisfied—Always

FOR SALE

Frequency Changer 60/40 Cycle

Motor: 2150 HP. 13000/6600 volt 3 phase 60 cycle 600 rpm.
Generator: 1770 KVA. General Electric 550 volt 3 phase 40 cycle 600 rpm.
Accessories: Complete with direct connected exciter, direct connected starting motor and complete control equipment.

ANDREN-MYERSON CORP.
411 Atlantic Ave., Boston, Mass.
Liberty 4300

TURBO UNITS—60 CYCLES
1—5000 KW G. E. condensing.
1—3200 KW Allis-Chalmers condensing.
1—2500 KW G. E. condensing.
1— 500 KW West. condensing.
1— 300 KW G. E. non-condensing.

TRANSFORMERS
Single Phase, 60 Cycle
3—150 KVA Pittsburgh, 6600/220-440 V.
3—100 KVA G. E. 13,200-6600/2200 V.
2— 75 KVA West. 6600/230-460 V.
2—37½ KVA Pittsburgh 2200/220-440 V.

ELECTRIC MOTORS
3 Phase, 60 Cycle
1—165 HP G. E. Syn. 2200 volt, 900 RPM.
1—125 HP West. Syn. 2200 volt, 1200 RPM.
1—100 HP Crocker-Wheeler Syn. 220/440 volt, 1200 RPM.
1—100 HP West. Type CW Slip Ring, 2200 volt, 700 RPM.

If you have equipment, please send us a list

TIPPINS MACHINERY COMPANY
3528 Forbes St. Pittsburgh, Pa.

NEED POWER EQUIPMENT?
(Try Us!!!)

BOILERS

POWER PLANT, with 2, 300 H.P. Boilers complete with 2, 500 KW, 3/60/2300 Turbines and Generators.
2—300 H.P. Water Tube Boilers
1—453 H.P. 160# Stirling W. T. Boiler
1— 47 H.P. Vert., 60" dia., ASME, 150#

COMPRESSORS

248 CFM Chi. Pneu. with 50 H.P. A.C. Motor
526 CFM Ingersoll-Rand—belt drive
780 CFM Chi. Pneu. with 125 H.P. A.C. motor
990 CFM Sullivan with 160 H.P. A.C. motor

ELECTRIC MOTORS

30 Units 15 to 75 H.P., squirrel cage, 3/60/440 A.C.
15 Units 3 H.P. to 60 H.P. 230 V D.C.

HOIST MOTORS

100 H.P. Northern G.E. Type, 220 D.C. 475 RPM, complete
20 H.P. Northern G.E. Type, 220 D.C. complete
(Write for our Electrical List)

GENERATORS

300 H.P. Buckeye Diesel Engine & Gen. 3/60/240.
500 KW G.E. Skinner Uniflow Steam Eng. Gen., 250 V. D.C.
100 KW G.E. Type ATB-2-1250-3600 Form T, 814 amps, 3/60/2200-900 RPM
5000 KW Turbo Generator, 3/60/2300 3600 RPM, 185# W.P.
POWER PLANT—Complete with two 625 KW Turbo Generators 3/60/2300, complete with 309 H.P. each Heine Water Tube Boilers, 225# steam pressure

1000 KW FREQUENCY CHANGER SET

25 to 60 cycles.
60 cycle unit, 4150 V
25 cycle unit, 9000 V
Complete with Starting Equipment.

HOISTS

Superior Iron Works single drum, 36" dia., with 80 H.P. G.E. type MTC motor
1 to 4 ton cap. single motor monorail type hoists

WANTED ! ! ! MACHINERY & EQUIPMENT OF ALL TYPES

IRON & STEEL PRODUCTS, INC.

13488 S. Brainard Ave. 38 YEARS' EXPERIENCE Chicago, Illinois

"Anything containing IRON or STEEL"

1—Stirling, W.T. 200#, 500 H.P.
2—200 H.P. HRT suspended, Type-E, stokers, coal bunker, breeching and stack.
1—54" x 12' COCHRANE (live steam) separator.
COMPLETE BOILER PLANT, (3) 166 H.P., HRT, suspended, 9' settings, motor driven under feed stokers, built 1934, 150#, pumps, heater, coal Lorry. All piping and Valves.

H. P. BREARLEY
3423—91st Street Jackson Heights, N. Y.

STEAM TURBO UNIT, 60 CYCLE

1—250 K.W., Kerr, Elliott Co. turbine 150/200# pressure condensing, fitted for Mixed Pressure operation at 2# low pressure, combined with 250 K.W. Allis Chalmers 3 ph., 60 cy., 2300 volt generator, 3600 RPM. Direct connected type exciter.

ARCHER & BALDWIN
INCORPORATED
75 WEST STREET, NEW YORK, N. Y.
Tel. "BOwling Green 9-9275-9276"

BOILERS
200# PRESSURE

2—350 HP with Char Grate Stokers
4—500 HP with Char Grate Stokers
1—300 HP with Char Grate Stokers
4—250 HP with Char Grate Stokers
4—300 HP Gas Fired

H. A. WOODWORTH ENGINEERING CO.
705 Olive St. Louis, Mo.

BOILERS

Big State Boiler & Engineering Co.

TELEPHONE : 3-4818
P. O. BOX 1974 • FORT WORTH, TEXAS

---

240 H.P. SUPERIOR DIESEL ENGINE

Model VDMB 6 Cylinder, 9" bore x 12" stroke, 500 RPM. Solid Injection. One way Clutch and Flexible Coupling.

ALJON ELECTRIC DIESEL CO.
151-55 Washington Street, Brooklyn, N. Y.
Main 4—3804-5

SMOKE STACK

160' high, 78" in diameter, Guyed wired ¼" material six years old

NATIONAL BOILER & EQUIPMENT CO.
2732 No. Talbott Ave., Indianapolis, Ind.

FOR SALE

Hoover, Owen and Rentschler, Class A, 22 x 42 heavy duty simple horizontal side crank Hamilton Corliss steam engine, 16 ft. flywheel, 36 in. belted service, 150 lbs non-condensing. Also Detroit Roto Stoker—3 rotors complete with stationary grates, A.C. motor drive and starting equipment, good for 300% rating on a 440 HP boiler.

THE SULLIVAN ELECTRIC COMPANY
838 Reedy St. Cincinnati, Ohio

LOCOMOTIVE CRANE

20 ton Link Belt 8 wheel locomotive crane, MCB, double drums, 50' boom, boiler ASME, just overhauled. Ready for work.

The Acme Equipment Company
14057 Schaefer Highway Detroit, Mich.

FOR SALE

Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

PENN MACHINERY COMPANY
Jackson, Miss.

FOR SALE

TRANSFORMERS - USED

Released from completed project
10 to 100 KVA
6600—120/240
6600—240/480
6600—110/220

also—Instrument Current
Instrument Potential

COLEMAN BROS. CORP.
Franklin Falls Dam
Franklin, N. H.

FOR SALE

2—*Fairbanks Morse* Style V, Type Y, 2 cylinder, 75 HP, 300 RPM Diesels direct connected to 60 KVA, 3 phase, 220 volt, 60 cycle alternators, complete with control.

1—*Fairbanks Morse* Style V, Type Y, 2 cylinder, 100 HP, 257 RPM—Diesel only.

All Diesels now in operation and may be inspected at any time.

CHARLES V. FISH
Commonwealth Bldg., Allentown, Pa.
PHONE 2-5500

REBUILT—MOTORS—TRANSFORMERS—M. G SETS—AIR OIL BREAKERS

MOTORS
Sq. Cage-220/440 V—3 Ph—60 Cy

HP	Make	Type	Speed
150	West.	CS	1800
150	G. E.	IK	600
125	Cr. Wh.	SC	900
100	G. E.	KT	514
100	G. E.	IK	900
75	G. E.	IK	720
75	G. E.	KT	900

Sq. Cage 220/440 V—3 Ph—25 Cy

150	G. E.	IK	750
100	G. E.	IK	750
75	G. E.	IK	500
75	G. E.	IK	750
50	G. E.	IK	750

Slip ring 220/440 V—3 Ph.—60 Cy

200	G. E.	IM	514
150	West.	CW	600
150	G. E.	IM	900
150	West.	HF	600
100	G. E.	IM	720
100	G. E.	MT 356	900

SL.R.G. 2300 V—3 Ph—60 Cy

HP	Make	Type	Speed
300	G. E.	IM	600
200	G. E.	IM	600
200	G. E.	IM	720
150	G. E.	IM	600
100	G. E.	IM	600
75	G. E.	MT 300	900

GENERATORS
AC—3 Ph—60 Cy

KVA	Make	Type	Volts	RPM
180	G. E.	ATB-PB	240	600
150	G. E.	ATB-P	240	900
100	G. E.	ATB-PB	2300	900
75	G. E.	ATB	2300	900
50	G. E.	ATB-P	240	1200
25	Diehl	9	220	1800

SPECIAL

1—25 KVA Diehl AC Gen. 240 V., 60 Cycle, 3 Phase, 1800 RPM with Belted Exciter on Base direct connected to 38-Buick Engine, can be used by gasoline or natural gas, all complete.

FOB Rochester.

MOTORS
DIRECT CURRENT
Variable Speed—230 Volts

HP	Make	Type	Speed
100	G. E.	MPC 6	300/600
50	G. E.	RF 14	500/1500
35	West.	SK	500/1500
25	Rel.	155 T	500/1500
25	Rel.	131 T	800/1600
25	West.	SK	300/1200
25	G. E.	RF 13	400/1200

CONSTANT SPEED
DC—230 V—Motors

150	West.	SK	1800
100	G. E.	CD	1200
75	West.	SK	1800
60	West.	SK	1800
40	West.	SK	1200
25	G. E.	RC	1800
25	West.	SK	1200
25	West.	SK	1800
20	West.	SK	900

CONSTANT SPEED
DC—115 Volt—Motors

15	West.	SK	900
15	West.	SK	1200
10	G. E.	RC	900
10	G. E.	RC	1200
7½	G. E.	RC	1200
5	West.	SK	1800
5	West.	SK 284	1200
5	West.	SK 30	1200

POWER EQUIPMENT CO.
519 Case Bldg.—82 St. Paul St. Phone Main 569 Rochester (4), N. Y.

FOR SALE

4000 KW TURBO-GENERATOR

1 Westinghouse Electric & Manufacturing Co. Turbo-Generator Turbine #2581, designed for 160 lbs. pressure at the throttle valve, direct connected to a generator #1,331,510, 3 phase, 60 cycle, 5000 KVA or 4000 KW at 80% P. F., 2300 volts, 3600 RPM, complete with Barometric Condenser, driven by a Terry steam turbine type C, and circulating pump, but no exciter; possibly complete with switchboard.

CITY OF HOLYOKE
GAS & ELECTRIC DEPT.,
70 Suffolk St. Holyoke, Mass.

DO YOU NEED LARGE LOW HEAD PUMPS?

We offer the following Allis Chalmers vertical centrifugal direct connected motor driven units:

#1. Type L. S. Size 42 x 36 48,000 GPM 31 ft. Hd. 319 RPM with 500 HP 2200 volt 3 phase 60 cycle motor.

#2. Type L. S. Size 42 x 36 48,000 GPM 31 ft. Hd. 319 RPM with 2 speed 2200 volt 3 phase 60 cycle motor 319/234 RPM.

#3. Type L. S. Size 42 x 36 35,000 GPM 31 ft. Hd. 350 RPM with 2 speeds 2200 volt 3 phase 60 cycle motor 350/240 RPM.

FS-552, Power
520 No. Michigan Ave., Chicago, Ill.

FOR SALE

Complete Refrigerating Plant

One (1) **York** two cylinder 9" x 9" vertical **ammonia compresser** driven through a flat belt 50 H.P. slip ring motor, starting equipment.
One (1) **Vilter** single cylinder 7" x 7" **ammonia compressor** with 15 H.P. square cage motor and started compensator.
One (1) double **pipe condenser** three stands wide, twelve stands high. Reconditioned by installing new ammonia pipes short time before plant was shut down.
Ammonia Receiver about 18" x 84".
One (1) **circulating pump** used with condenser and spray pond.
One (1) **steel surge tank.**

WILLIAM C. SCHMIDT
302 Atlantic Life Bldg., 6th and Main Sts.
Richmond, Virginia

NEW and USED EQUIPMENT AVAILABLE

for
Power Plants, Sub-Stations, Transmission Lines and Construction
Send for new list . . . to
—APPARATUS EXCHANGE
EBASCO SERVICES INCORPORATED, TWO RECTOR ST., NEW YORK, N. Y.

FOR SALE

Two rebuilt Semi Pulverizing Stokers

GEO. S. HERRICK GRATE CO.
110 Liberty St. Syracuse, N. Y.

FOR SALE

"JEFFERY" Single Roll Coal Crusher—Size 30" x 30", capacity 60-70 tons hourly, also "Jeffery" Swing Hammer Pulverizer—M.D. — Type A-24" x 12" — Capacity one ton hourly.

GLOBE TRADING CO.
920 W. Lafayette Blvd. Detroit, Mich.
CA. 0198

FOR SALE

One 100 K. W. 250 volt D. C. **Turbo Generator Turbine-Curtis** Form C, 2 stage 3600 R.P.M. 150# S.W.P.
Generator—100 K. W. **General Electric** Type MFC, Class 4-100-3600 Form T, 400 Amps 250 volts D. C.

PILOT MARINE CORP.
25 Beaver Street New York, New York

FOR SALE **BOILER**

Erie "Economic" water tube boiler—40 H.P. coal burning complete with 40 foot steel stack. In excellent condition—12 years old. This boiler is now in service and will be available in 60 days. Being replaced for larger capacity unit.

ACCURATE MANUFACTURING CO.
44 Hepworth Place, Garfield, N. J.
Phone Passaic 2-0118

FOR SALE
Allis-Chalmers, 60 KW

TURBO-GENERATOR

3 phase, 60 cycles, 240 volts, 180 amps., 3600 RPM, with direct driven exciter, complete with necessary handles, chains, rheostats and meters.

FS-551, Power
520 No. Michigan Ave., Chicago, Ill.

FOR SALE

2 Ridgeway engines, 12 inch bore, 14 inch stroke, 96 H. P., 290 R. P. M., direct connection to Sprague Electric Generator 60 K. W., 120 Voltage, 480 Amp.

Inquire **MILTON ROSENBLUM**
591 Summit Av. Jersey City, N. J.
Journal Square 2-0055

TURBINE

375 KVA Westinghouse Turbine, Condenser and auxiliaries. 3-60-208.

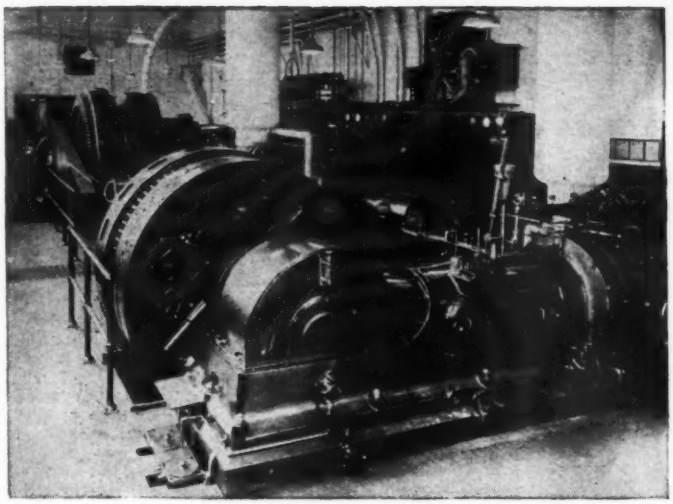
Reconditioned

THE PURITAN HOTEL
Louisville, Ky.

Your inquiry
will have special value . . .

if you mention this magazine, when writing advertisers. Naturally, the publisher will appreciate it . . . but, more important, it will identify you as one of the men the advertisers wants to reach with his message and help to make possible enlarged future service.

COMPLETE POWER PLANT



IMMEDIATE DELIVERY!

Will sell subject to Government regulation and prior sale.

3 Skinner Uniflow engines with Westinghouse generators and exciters rated 1000—375—62½ kva, all 440v—60C—3ph.

Also include 2 HRT Nu-Way boilers rated 255bhp each with Whitin stokers, etc. Plant open for inspection.

P.O. Box 852, La Crosse, Wis.

WANTED

WANTED PUMPS and TRANSFORMERS

1—1500 G.P.M. Underwriter Sprinkler Pump, Motor Driven, 3 ph.—60 cy.—220 V. or 208 V. with Controller

1—1500 G.P.M. Underwriter Pump, Turbine Driven, 125# Guage Dry, Throttle Steam and Zero Lbs. Back Pressure

1—150 G.P.M., 2½" x 2" Double Suction. Single Stage, Centrifugal Pump. 100# total Dynamic Head with 15 H.P. 3 ph., 60 cy., 220 V. Motor and Control

3—333 K.V.A. G.E. or West. Oil Cooled Transformers, 2400/125 V. or 4150/208 V.

DAVIDSON INDUSTRIAL CONTRACTING CO.

343 Classon Ave. Main 2-2400 Brooklyn, N. Y.

WANTED

Two (2) Used Boilers

250 to 300 Rated Horse Power
H.R.T. Fire Tube

Required for one of our New England Plants. Prefer not over ten years old — Should have stokers and such auxiliary equipment as stack, feed water pump, heater, regulator instruments.

Address all replies:

COLLINS & AIKMAN CORPORATION
PLANT "L"
UPLAND, DELAWARE COUNTY, PA.
Telephone: Chester 4167

—TRANSFORMERS—

TRANSFORMERS WANTED

in operating condition or burnt out. Mail us list giving complete nameplate data and stating condition.

We Rewind, Repair and Redesign all Makes and Sizes
ALL TRANSFORMERS GUARANTEED FOR ONE YEAR
We will be pleased to quote prices on request.

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI, OHIO

WANTED FOR CASH

1—Motor Generator Set consisting of a 75 or 100 kw, 125 volt compound wound interpole direct current generator direct connected to a 3 phase, 60 cycle, 220 volt synchronous motor complete with a direct current panel with instruments and A.C. controls.

W-558, Power
520 No. Michigan Ave., Chicago, Ill.

ADVERTISERS' INDEX

Where an * appears after a name the advertisement does not appear in this issue, but appeared in preceding issues.

Aircraft & Diesel Equipment Corp.....150
Airetool Mfg. Co.....*
Air-Maze Corp.....*
Air Preheater Corp.....219
Air Reduction.....*
Air Transport Ass'n of America for Railway Express Agency.....282
Ajax Flexible Coupling Co.....*
Alco Products Division.....*
Aldrich Pump Co.....281
Alexander Hamilton Institute, Inc.....*
Allen-Sherman-Hoff Co.....*
Allis-Chalmers Mfg. Co.....18, 25, 43
Alloy Steel Products Co.....*
Allpax Co., Inc.....178
American Blower Corp.....56–57
American Brass Co.....125, 147
American Chain & Cable Co.....136
American Chimney Co.....*
American Coal Burner Co.....174
American District Steam Co.....290
American Engineering Co.....20–21
American Locomotive Co.....*
American Metal Hose Branch.....147
American Pulley Co.....42
American Pulverizer Co.....*
American Radiator & Standard Sanitary Corp.....56–57
Anchor Packing Co.....185
Anderson Co., V. D.....301
Armor-Clad Co.....306
Armstrong Machine Works.....40–41
Askania Regulator Co.....*
Associated Piping & Engineering Co.....142
Atlas Valve Co.....*

Babbitt Industrial Specialties Co.....162
Babbitt Steam Specialty Co.....184
Babcock & Wilcox Co.....4–5
Babcock & Wilcox Tube Co.....*
Bacharach Industrial Instrument Co.....290
Badger & Sons, E. B.....218
Bailey Meter Co.....10–11
Baldwin De La Vergne Sales Corp.....123
Baldwin-Hill Co.....186
Baldwin Locomotive Works.....123
Bartlett & Snow Co., C. O.....*
Bates Co., Walter.....176
Beaumont Birch Co.....215
Belmont Packing & Rubber Co.....285
Bendix Aviation Corp.....*
Betz, W. H. & L. D.....187
Biddle Co., James G.....283
Bigelow-Liptak Corp., Division A. P. Green Fire Brick Co.....268
Bird-Archer Co.....297
Blaw-Knox Co.....131
Boiler Tube Co. of America.....246
Bonney Forge & Tool Works.....148
Borg Warner Corp.....272
Botfield Refractories Co.....286
Brickseal Refractory Co.....*
Bridgeport Brass Co.....*
Briggs Clarifier Co.....264
Brooks Equipment Corp.....*
Brownell Co.....296
Brown Instrument Co.....201
Brunt Equipment Co.....306
Buell Engineering Co., Inc.....160
Buffalo Forge Co.....293
Buffalo Pumps, Inc.....309
Burgess Battery Co.....213
Burke Electric Co.....*
Byers Co., A. M.....62

Canton Stoker Corp.....308
Carborundum Co.....291
Cardox Corp.....211
Carey Mfg. Co., Philip.....216
Carrier Corp.....305
Cash Co., A. W.....243
Chapman Valve Mfg. Co.....143
Chicago Metal Hose Corp.....158
Chicago Pneumatic Tool Co.....*
Cities Service Oil Co.....257
Clarage Fan Co.....238
Clark Bros. Co.....*
Cleaver-Brooks Co.....*
Climax Engineering Co.....*
Clipper Mfg. Co.....*
Cochrane Corp.....284, 287, 294
Coe Mfg. Co.....296
Coffin Jr. Co., J. S.....156
Combustion Engineering Co.....8–9
Condenser Service & Engineering Co.....*
Connery Construction Co.....209
Cooper-Bessemer Corp.....260
Coppus Engineering Corp.....137
Corning Glass Works.....*
Crane Company.....127
Crane Packing Co.....245
Cryer Trap & Valve Co.....*
Cutler-Hammer, Inc.....115

Dampney Co. of America.....205
Darling Valve & Mfg. Co.....167, 177
Dart Mfg. Co., E. M.....154
Davis Regulator Co.....286
Dearborn Chemical Co.....*
De Bothezat Ventilating Equipment Div. American Machine & Metals, Inc.....*
DeLaval Steam Turbine Co.....58, 174
Deming Company.....*
Detrick Co., M. H.....267
Detroit Stoker Co.....44–45
Diamond Power Specialty Corp.....16–17
Dixon Crucible Co., Joseph.....201
Dowell, Inc.....191
Downingtown Iron Works.....*
Dugas Engineering Corp.....*

Eagle-Picher Lead Co.....*
Economy Pumps, Inc.....290
Edge Moor Iron Works.....181
Edward Valve & Mfg. Co., Inc.....141
Ehret Magnesia Mfg. Co.....263
Elastic Stop Nut Corp. of America.....236
Electric Controller & Mfg. Co.....232
Electric Storage Battery Co.....*
Electro Metallurgical Co.....*
Elliott Company.....6–7
Engineer Company.....202
Eureka Packing Co.....186
Everlasting Valve Co.....*

Fairbanks Co.....165
Fairbanks, Morse & Co.....234
Fairfield Engineering Co., The.....230
Fawick Airflex Co., Inc.....248
Fedders Mfg. Co., Inc.....190
Federal Refractories Corp.....*
Fischer & Porter Co.....*
Fisher Governor Co.....*
Flexrock Co.....184
Fluor Corp., Ltd., The.....*
Flynn & Emrich Co.....195
Foote Bros. Gear & Machine Corp.....51
Foster Engineering Co.....262
Foster Wheeler Corp.....24
Foxboro Company.....*
France Packing Co.....194
Frederick Iron & Steel Co.....178
Frick Company.....*
Fuller Company.....*
Gardner-Denver Co.....*
Garlock Packing Co.....49
General Coal Co.....*
General Electric Co.....26–27, 50, 270
General Motors Diesel Engine Div.....256
Gifford-Wood Co.....*
Gilmer Co., L. H.....*
Globe Steel Tubes Co.....155
Goetze Gasket & Packing Co., Inc.....202
Golden-Anderson Valve Specialty Co.....179
Goodyear Tire & Rubber Co.....33
Goulds Pumps.....*
Graver Tank & Mfg. Co.....299
Greene, Tweed & Co.....207
Grinnell Co.....Third Cover
Grove Regulator Co.....242
Gulf Oil Corp.....241
Gulf Refining Co.....241

Hagan Corporation.....38–39
Hall Laboratories.....*
Haynes Stellite Co.....*
Hays Corporation.....161
Hays Institute of Combustion.....*
Hendy Iron Works, Joshua.....193
Henszey Co.....182
Hercules Float Works.....174
Hoffman Specialty Co.....*
Homestead Valve Mfg. Co.....226
Honan-Crane Corp.....180
Huyette Co., Inc., Paul.....164

Illinois Water Treatment Co.....209
Imperial Brass Mfg. Co.....198
Infilco Inc.....228
Ingersoll-Rand Co.....244
International Nickel Co.....32, 163
Iron Fireman Mfg. Co.....52–53

Jenkins Bros.....132–133
Johns-Manville.....129
Johnson Service Co.....192
Johnston & Jennings Co.....231
Jones & Laughlin Steel Corp.....*
Jones Foundry & Machine Co., W. A.....300

Keasbey & Mattison Co.....224
Kellogg Co., M. W.....227
Kennedy Valve Mfg. Co.....171
Kewanee Boiler Corp.....178
Kieley & Mueller.....292
Koppers Co.....*

Laclede-Christy Clay Products Co.....206
Ladish Drop Forge Co.....247
Laminated Shim Co.....194
Leavitt Machine Co.....303
Leeds & Northrup Co.....Second Cover
Lincoln Electric Co.....189
Linde Air Products Co., The.....*
Link-Belt Co.....3
Lonergan Co., J. E.....172
Lubriplate Division Fiske Bros. Refinery Co.....217
Ludlow Valve Mfg. Co.....180
Lummus Company.....153
Lunkenheimer Co.....28–29

Macmillan Petroleum Corp.....235
Magnaflux Corporation.....254
Magnolia Metal Co.....*
Manhattan Rubber Mfg. Division Raybestos-Manhattan.....166
Manzel Bros. Co.....*
Mark & Co., Clayton.....*
Marley Company.....221
Marsh Corp., James P.....*
Martindale Electric Co.....*

Maxim Silencer Co. 199
McGraw-Hill Book Co. 298, 302, 308
Midwest Piping & Supply Co. 225
Minneapolis-Honeywell Regulator Co. 201
Monsanto Chemical Co. 140
Morse Chain Co. 272
Multiple V-Belt Drive Assn. 203
Murray Iron Works Co. 138

National Airoil Burner Co., Inc. ..... *
National Aluminate Corp. 121
National Supply Corp. ..... *
National Valve & Mfg. Co. 274
Niagara Blower Co. 304
Nicholson Company 207
Nicholson & Co., W. H. 172
Nordberg Mfg. Co. 251
Northern Equipment Co. 135
Norton Company 210
Nugent & Co., W. W. ..... *
National Tube Co. ..... *

Oakite Products, Inc. 176
Ohio Injector Co. 237
Ozalid Products Division 223

Pacific Pump Works ..... *
Peabody Engineering Corp. ..... *
Permutit Company ..... Back Cover
Philadelphia Gear Works 278
Pipe Fabrication Institute 279
Pittsburgh Piping & Equipment Co. 269
Plant Rubber & Asbestos Co. 240
Plibrico Jointless Fire Brick Co. ..... *
Pomona Pump Co. 229
Porter & Co., H. W. ..... *
Powell Co., Wm. 54–55
Powers Regulator Co. 306
Prat-Daniel Corp. ..... *
Precision Development Co. ..... *
Preferred Utilities Co. 284
Pritchard & Co., J. F. ..... *
Proportioneers, Inc. ..... *

Quaker Rubber Corp. 300
Quigley Co. ..... *

Raybestos-Manhattan, Inc. 166
Reading, Pratt & Cady Division 169
Reeves Pulley Co. ..... *
Reliance Electric & Engineering Co. 275
Reliance Gauge Column Co. 34–35
Republic Flow Meters Co. 14–15
Republic Steel Corp. ..... *
Research Corp. ..... *
Revere Copper & Brass Inc. ..... *
Rhoads & Sons, J. E. ..... *
Richardson Scale Co. ..... *
Ric-Wil Company 265
Riley Stoker Corp. 96–97
Robbins & Myers, Inc. 249
Robins Conveyors, Inc. ..... *
Rockbestos Products Corp. 222
Rockwell Co., W. S. 286
Roebling's Sons Co., John A. 229
Rogers Diesel & Aircraft Corp. 46
Roper Corp., Geo. D. 310
Ross Heater & Mfg. Co. ..... *
Roto Company 186
Ruberoid Co., The 159
R-S Products Corp. 144

Sarco Co., Inc. ..... *
Sauerman Bros., Inc. 170
Schaub Engineering Co., Fred H. ..... *
Schramm, Inc. 200
Scovill Mfg. Co. ..... *
Shaw Co., Benjamin F. 19
Shell Oil Co. 149
Simplex Valve & Meter Co. ..... *
Sinclair Refining Co. 253
Sivyer Steel Casting Co. 145
SKF Industries, Inc. 259
Skinner Engine Co. ..... *
Sloan Valve Co. 47
Smith Refractories Inc., Sanford C. 306
Smooth-On Mfg. Co. 282
Socony-Vacuum Oil Co. 197
Springfield Boiler Co. ..... *
Square D Co. ..... *
Squires Co., C. E. 295
Standard Oil Co. of California ..... *
Standard Oil Co. of Indiana 151–152
Standard Pressed Steel Co. 215
Star Test Pocket Pliers 306
Staynew Filter Corp. 252
Steel & Tubes Division ..... *
Stephens-Adamson Mfg. Co. ..... *
Stickle Steam Specialties Co. 168
Stock Engineering Co. 292
Strong, Carlisle & Hammond Co. 298
Sturtevant Co., B. F. 12–13
Sturtevant Mill Co. ..... *
Sullivan Machinery Co. 36–37
Sun Oil Co. 119
Superior Diesel Engine Div. ..... *
Swartwout Co. 336
Syntron Company ..... *

Talon, Inc. 239
Tal's Prestal Bender, Inc. ..... *
Taylor & Co., W. A. ..... *
Taylor Forge & Pipe Works 266
Taylor Instrument Companies ..... *
Terry Steam Turbine Co., The 183
Texas Company 30–31
Thermoid Rubber Div. ..... *
Tide Water Associated Oil Co. 270–271
Timken Roller Bearing Co. 280
Todd Combustion Equipment Co. 233
Toledo Pipe Threading Machine Co. 307
Trill Indicator Co. ..... *
Tripp Metallic Packing Co. 306
Troy Engine & Machine Co. ..... *
Tube-Turns, Inc. 139

Union Asbestos & Rubber Co. 258
Union Carbide & Carbon Corp. ..... *
Universal Zonolite Insulation Co. 175
U. S. Machine Corp. ..... *
U. S. Rubber Co. 157
U. S. Steel Corp. Subsidiaries ..... *

Viking Pump Co. 170
Vogt Machine Co., Henry 214
Vose Co., J. H. H. 302

Walworth Co. 261
Warren Steam Pump Co. 196
Water Treatment Co. of America 146
Watson-Stillman Co. 255
Webster & Co., Warren ..... *
Westinghouse Electric & Mfg. Co. 60–61
Weston Electrical Instrument Co. 295
Wheelco Instruments Co. 208
Where to Buy 306
Whitlock Mfg. Co. ..... *
Wickwire Spencer Steel Co. ..... *
Wiedeke Co., Gustav 296
Wilkening Mfg. Co. ..... *
Williams Gauge Co. 307
Wilson Inc., Thomas C. 173
Wing Mfg. Co., L. J. 273, 295
Wolverine Tube Division 212
Wood's Sons Co., T. B. 250
Woodward Governor Co. ..... *
Worthington Pump & Machinery Corp. 277
Wright Mfg. Division 136

X-Pando Corp. 307
Xzit Sales Co. 184

Yarnall-Waring Co. 22–23, 117, 215, 304
Youngstown Sheet & Tube Co. 48

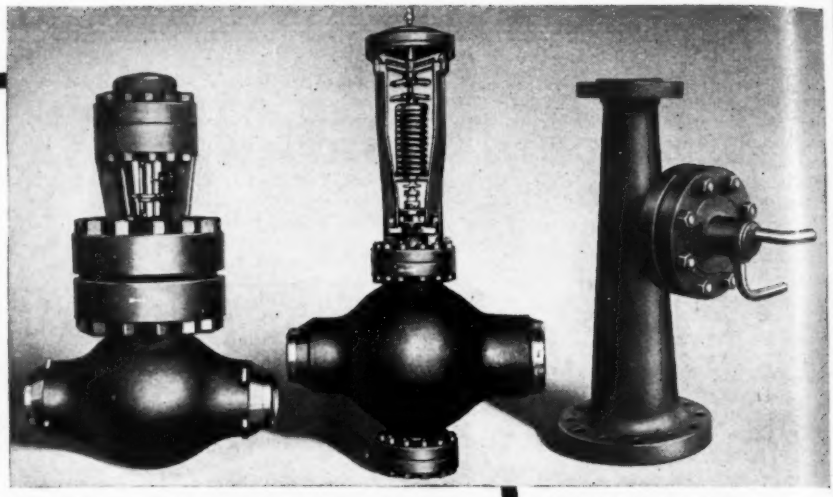
PROFESSIONAL SERVICES **306**

SEARCHLIGHT SECTION

(Classified Advertising)

Classification	Page
BUSINESS OPPORTUNITIES	311
EMPLOYMENT SERVICES	311
MOTOR REWINDING	311
Hunt, C. V.	311
POSITIONS VACANT	311
POSITIONS WANTED	311
SELLING OPPORTUNITIES	311
WANTED TO PURCHASE	333
USED AND SURPLUS EQUIPMENT	311-333
Accurate Mfg. Co.	332
Acme Equipment Co.	331
Afgo Engineering Corp.	311
Aljon Electric Diesel Co.	328, 331
Andrew-Myerson Corp.	331
Archer & Baldwin Inc.	331
Belyea Co., Inc.	316
Berger Bros. Elect. Mts. Inc.	314
Big State Boiler & Engr. Co.	331
Birch Manufacturing Co.	329
Brearley, H. P.	331
Brew, Woltman & Co., Inc.	325
Brill Equipment Corp.	328
Chicago Construction Equip. Co.	329
Chicago Electric Co.	324
Coleman Bros. Corp.	332
Collins & Aikman Corp.	333
Crawbuck Co., John D.	329
Davidson Industrial Contracting Co.	333
Davis, J. F.	329
Douglass Co., Stephen A.	330
Duquesne Electric & Mfg. Co.	319
Ebasco Services Inc.	332
Electric Apparatus Repair Co.	330
Electric Equipment Co.	323
Electric Motor & Machinery Co.	328
Electric Motor & Repair Co.	329
Electric Service Co., Inc.	333
Ellis Co., A. Lee	231
Emsco Equip. Co.	326
Erie Electric Co., Inc.	324
Eveready Electric & Supply Co.	330
Fish, Charles V.	332
Fletcher Sales Co.	326
Globe Trading Co.	332
Glow Electric Co.	330
H & P Machinery Co.	330
Hall & Co., Inc., Stephen	329
Harrison, Chas. G.	311
Heat & Power Co.	321
Hemphill & Co., Inc., J. L.	313
Herrick Grate Co., George S.	332
Holyoke, City of	332
Hooper, James K.	328
Hunt's Sons, M. J.	330
Iron & Steel Products, Inc.	331
Jackson-Bayley Electric Co.	328
Keystone Power Plant Eq. Co.	326
Kiemle Co., F. W.	314
Kirk Co., Wallace C.	327
Land & Co., L. J.	318
MacCabe Co., T. B.	325
Metropolitan Plumbing Supply Co., Inc.	327, 330
Mississippi Valley Equipment Co.	327
Moore & Co.	330
Moorhead-Reitmeyer Co., Inc.	328
National Boiler Equipment Co.	331
National Power Machinery Co.	312
O'Brien Machy. Co.	315
Penn Mchy. Co.	331
Philadelphia Transformer Co.	327
Pilot Marine Corp.	332
Pittsburgh Plate Glass Co.	311
Power Equipment Co.	332
Power Plant Equipment Co., Inc.	322
Puritan Hotel	324
Rearick, Charles B.	328
Rockford Electric Equip. Co.	330
Rosenblum, Milton	332
Ross Power Eq. Co.	330
Schmidt, William C.	332
Schoonmaker Co., A. G.	327, 330
Stewart & Co., Inc., Paul	317
Sullivan Co., Joe	328
Sullivan Electric Co.	331
Sullivan, W. L.	311, 326
Sundfelt Equipment Co.	330
Tippins Machinery Co.	331
Utilities Electrical Machinery Co.	320
Wente Electric Co.	327
Wilms, Weaver & Co.	322
Woodworth Engineering Co., H. A.	331

Dependability you can bank on is built into every item of

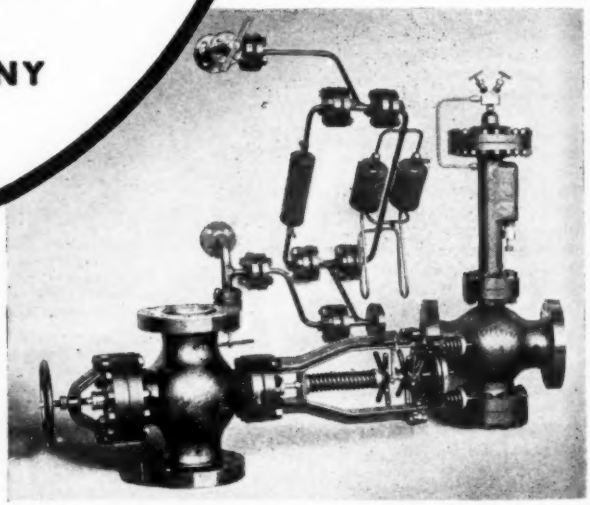


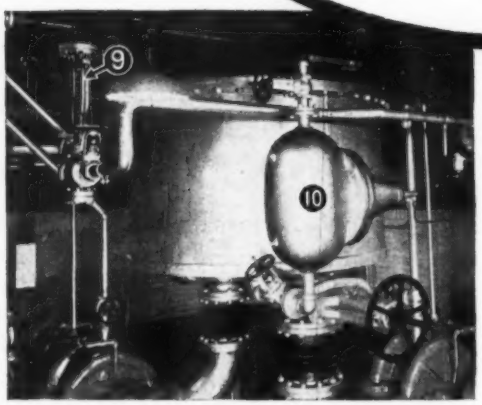
SWARTWOUT EQUIPMENT

Swartwout Controls for "both ends" of the boiler have a well-earned reputation for consistent performance and long life *with a minimum of maintenance.* From feed water heating to final control of steam pressures and temperatures, their rugged construction and engineered fitness for each specific job backs up the thirty-eight year old Swartwout guarantee of "complete satisfaction."

THE SWARTWOUT COMPANY
18501 Euclid Avenue
Cleveland, Ohio

REDUCING AND DESUPERHEATING
High pressure unit in which Swartwout furnished the whole station including the control master regulators and the water admission valves. Large valve on left is single seated, quick opening valve which cuts in in an emergency.

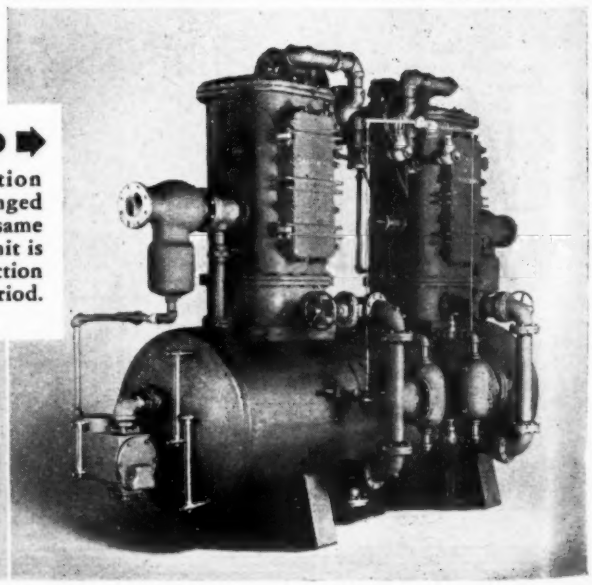




FEED WATER REGULATION and EXCESS PRESSURE CONTROL
900 pound standard unit in central generating station. Extra generator operates high and low water alarm system.

LIQUID LEVEL CONTROL
The air-actuated pilot-type float control operates by-pass valve in the line between the discharge of the condensate pump and the condensate hot well, thereby insuring a minimum "head" on the suction side of the pump.

FEED WATER HEATING AND DEAERATING. Twin installation with piping and shutoff valves arranged so both units can be operated at same time, or either alone. Thus one unit is available for cleaning and inspection during the low week-end load period.

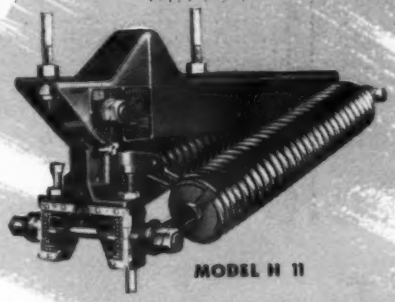


Feed Water Regulators • Pump Governors • Feed Water Heaters
Master Controls • Reducing Valves • Separators • Exhaust Heads

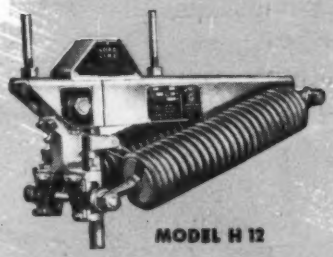
Swartwout

•Power Plant Equipment•

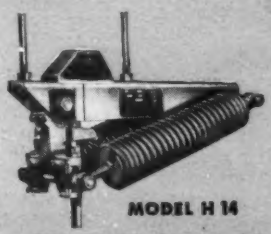
3 Genspring Hangers meet LOAD-TRAVEL SPECIFICATIONS!



MODEL H 11



MODEL H 12



MODEL H 14

The entire range of load-travel specifications is met by 3 models of Genspring Hangers – each model of standardized physical dimensions.

Only Genspring Hangers offer these highly important features for suspension of high temperature piping:

- **. . . constant-support of piping in all "hot" and "cold" positions.**
- **. . . full safety factor of the supported system is always maintained.**
- **. . . mass produced from standard precision parts.**
- **. . . individually calibrated for each specific installation.**
- **. . . load adjustment features incorporated into the design.**
- **. . . the rated capacity of each model varies with the size of the springs used – the overall dimensions of the hanger remain constant.**
- **. . . minimum head room required.**

LOAD-TRAVEL PRODUCTS in POUNDS and INCHES

MODEL NO.	TOTAL TRAVEL (Inches)		SPRING SIZES											
	Min.	Max.	1A	1	2	3	4	5	6	7	8	9	10	11
H 11	2	4	.....	1190	1620	2300	3390	4775	6185	8150	9765	11765	13995	15305
H 12	1¾	3¼	.....	.....	.....	.....	2770	3900	5056	6675	7975	.....	.....	.....
H 14	1¼	2½	515	640	870	1230	1820	2555	.....	.....	.....	.....	.....	.....

NOTE: To obtain Rated Capacity for a given Total Travel, divide the Load-Travel Product by that Total Travel.

WRITE FOR Data Book containing complete details of Genspring Constant-Support Hangers, for loads from 250 to 8500 lbs. Grinnell Co., Inc., Executive Offices, Providence, R. I. Branch offices in principal cities.

GENSPRING CONSTANT-SUPPORT HANGERS BY **GRINNELL**

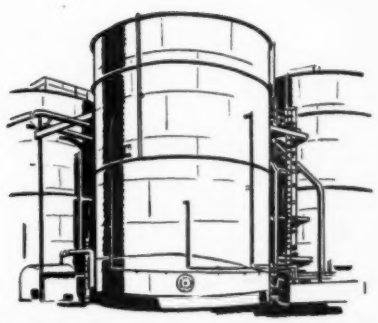
WHENEVER **PIPING** IS INVOLVED

The war job you are doing deserves this protection, too

Heavy war loads bring extra dangers of shutdowns to repair boilers, auxiliaries and steam lines damaged by impurities in the feedwater. But not at Permutit*-equipped plants. Permutit water conditioning puts control of water quality squarely in the hands of plant engineers. Results are summed up by this report from a plant which recently went on 24-hour operation: "Since installing Permutit three years ago, we have found *no scale or corrosion* in our boilers."

Permutit makes every type of water conditioning equipment. Processes developed during 30 years of pioneering include Zeo-Karb*, hot lime soda softeners, deaerating heaters, the new Demineralizing Process, silica removal and continuous blowoff equipment.

Good water by Permutit is helping to insure continued production at thousands of war plants. *Your* war job needs this support, too. Write us about your problem: The Permutit Co., Dept. A., 330 West 42nd St., New York, N. Y. In Canada: Permutit Co. of Canada, Ltd.... Montreal ... Toronto ... Winnipeg ... Calgary. *Trademarks Reg. U. S. Pat. Off.



PERMUTIT SILICA REMOVAL PROCESS

reduces silica content to any degree desired, eliminates scale and deposits. Reagents used are low in cost and do not add soluble by-products. It's adaptable to hot or cold lime soda treatment or to Permutit's Demineralizing Process, and can be applied to existing equipment.

PERMUTIT

WATER CONDITIONING HEADQUARTERS

SERVING INDUSTRY AND THE ARMED FORCES . . . WITH GOOD WATER